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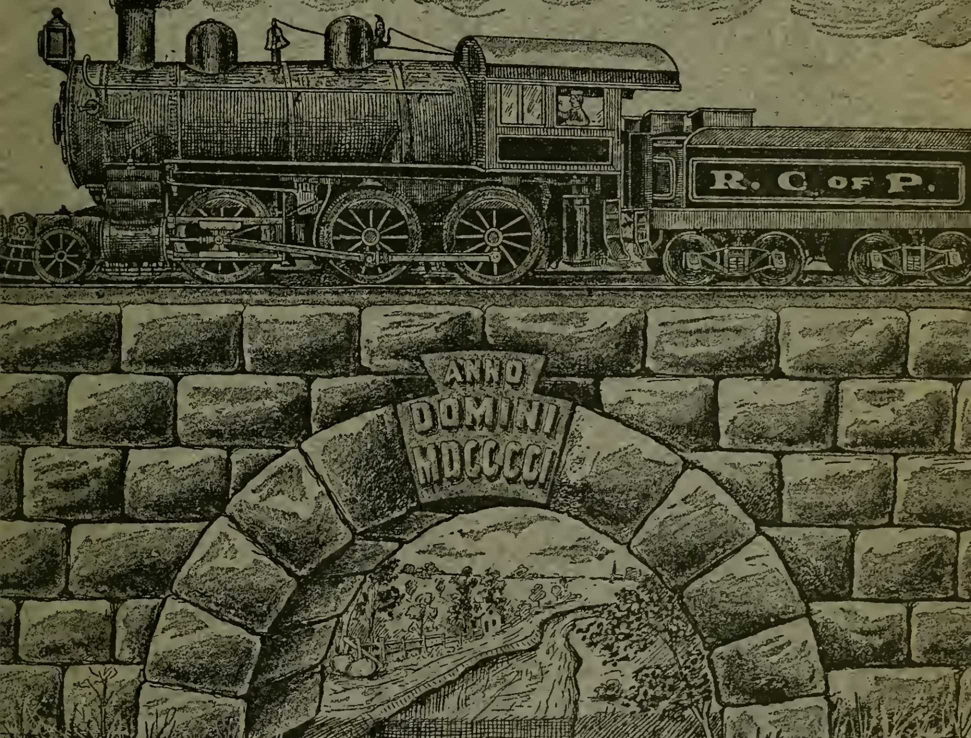

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PENNSYLVANIA.

PENNSYLVANIA CAR WHEEL CO.

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For Steam, Electric Railways, and Mill Service.

THE LARGEST OUTPUT
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FRICK BUILDING, PITTSBURG, PA.

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WE ARE NOW CASTING......

400 WHEELS DAILY

AT OUR NEW CAR WHEEL FOUNDRY, AND ARE BOOKING ORDERS FOR IMMEDIATE DELIVERY.

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25 WEST 33D ST.
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DEPEW, N. Y.
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ELECTRIC CAR LIGHTING
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PAINT AND VARNISH MAKERS.

Cleveland, Newark, San Francisco, Montreal,
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New York, Kansas City, Minneapolis, Winnipeg,

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Freight, Passenger and Locomotive.

Malleable Iron Castings for Railroad Use.

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GOLD CAR HEATING CO.
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The Gold Straight Port Coupler is the only one extant having an Adjustable Brass-Faced Seat.

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Branch Office: 614 Rookery,
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No. 6 Bridge Stores,
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MAGNUS METAL
MEETS ALL HIGH-GRADE REQUIREMENTS.

IT IS THE STANDARD METAL
FOR LOCOMOTIVE WEARING PARTS,

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D. M. HOWE, LEWIS BLOCK, PITTSBURG,

Will send upon request, a set of mailing card, illustrating notable steel railroad bridges protected with Dixon's Silica-Graphite Paint.

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Westinghouse
Friction Draft Gear.

The Westinghouse Friction Draft Gear is a gradually applied and automatically released frictional resistance which absorbs the shocks delivered to train during buffing and pulling operations. . . . .

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The Westinghouse Air Brake Co.
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OUR LEADER THIS MONTH IS

NORTON JACKS

50 STYLES. 8 to 70 TONS CAPACITY.

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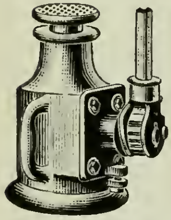
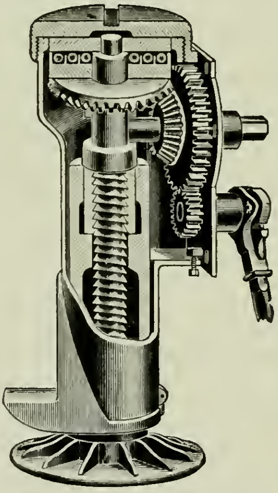
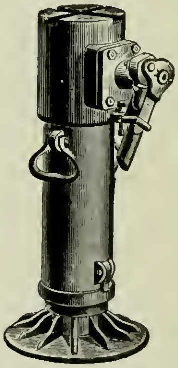


Style K, 15 Tons.
The Car Inspector's Pet.



Style B. J., 70 Tons, 26″ high.
This Jack should be in every Wrecking Car.



Style C. 35 Tons, 26 & 31″ high
Specially fitted for heavy Car and Loco. work.

We are also SALES AGENTS for the following:

Leviathan Belting and Supplies.
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Jackson Belt Lacing Machines and Supplies.
Swain Metallic Packing and Lubricators.
Buckeye Lights, Heaters and Painting Machines.
Keasey Wood Split Pulley. Clancy Rust Proof Hose Clamps.

OFFICIAL PROCEEDINGS

of the

Railway Club *of* Pittsburgh.

ORGANIZED OCTOBER 18, 1901.

OFFICERS, 1902 - 1903.

President,
J. H. McCONNELL,
Manager American Locomotive Co., Pittsburgh, Pa.

Vice-President,
L. H. TURNER,
Supt. Motive Power, P. & L. E. R. R.
Pittsburgh, Pa.

Treasurer,
J. D. McILWAIN,
Sales Agent, J. D. McIlwain & Co.,
Pittsburgh, Pa.

Secretary,
J. D. Conway,
Chief Clerk, Supt. M. P., General Offices P. & L. E. R. R , Pittsburgh, Pa.

Executive Committee,

D. F. CRAWFORD,
Supt. M. P. Penna. Lines West of Pgh.,
Ft. Wayne, Ind.

J. E. SIMONS,
Treasurer Fox Foundry and Machine Co.,
New Kensington, Pa.

F. T. HYNDMAN,
S. M. P., Bflo., Roch. & Pgh. R. R. Co.,
Du Bois, Pa.

Vol. II.
No. 1.

Pittsburgh, Pa., November 28, 1902.

$1.00 Per Year.
20c. per Copy.

Published monthly, except June, July and August, by the Railway Club of Pittsburgh,
J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
NOVEMBER 28, 1902.

The meeting was called to order at 2 o'clock P. M., at the Hotel Henry by Secretary Conway, in the absence of President McConnell and Vice President Turner.

The following gentlemen registered:

MEMBERS.

Blackall, Robt. H.
Carson, G. E.
Conway, J. D.
Groenlie, F. E. O.
Hastings, Chas. L.
Hogan, Sylvester.
Holbrook, David O.
Howe, David M.
Hussey, John U.
Hyndman, F. T.
Lininger, W.
Malloy, M. A.
McFeatters, F. R.
McIlwain, J. D.
Pelletier, Louis.
Reagan, P. J.
Redding, D. J.
Slocum, C. V.
Watts, H. W.
Whitney, Louis B.
Whitton, R. L.

VISITORS.

Smith, Sion B.
Reese, F. T.
Taylor, W. E.

Upon motion, Mr. J. E. Simons was elected chairman pro tem.

Chairman: The minutes of the proceding meeting have been printed, and if there is no objection they will stand approved as printed. I hear no objection, and it is so ordered.

The Secretary announced the following proposals for membership in the Club.

W. E. Connolly, Superintendent Pennsylvania Car Wheel Company, No. 499 Preble avenue, Allegheny, Pa.

Frank B. Hart, Manager of Sales Excelsior Car Roof Company, No. 1167 Fourteenth avenue, Detroit, Mich.

Chas. L. Hastings, Representative Bethlehem Steel Company, Keystone Bank Building, Pittsburgh, Pa.

E. S. Reiley, General Manager Fort Pitt Malleable and Gray Iron Company, No. 326 Fourth avenue, Pittsburgh, Pa.

R. F. Hunter, Vice President Hukill-Hunter Company, First avenue and Wood street, Pittsburgh, Pa.

P. J. Reagan, Representative Hukill-Hunter Company, First avenue and Wood street, Pittsburgh, Pa.

E. H. Symington, Mechanical Engineer Kilbourne & Jacobs Manufacturing Company, Columbus, O.

Geo. H. Thompson, City Passenger Agent Pittsburgh & Lake Erie Railroad Company, Park Building, Pittsburgh, Pa.

O. P. Rank, Traffic Department Pittsburgh Coal Company, Pittsburgh, Pa.

Geo. A. Post, President Standard Coupler Company, 160 Broadway, New York, N. Y.

R. C. Hallett, Manager Auto Heating Company, Keystone Bank Building, Pittsburgh, Pa.

Frank Carpenter, Representative Keystone Car Wheel Company, Park Building, Pittsburgh, Pa.

D. B. Kennedy, Representative Wm. B. Scaife & Sons Co., Pittsburgh, Pa.

Jas. K. Cullem, President Niles Tool Works, Hamilton, O.

C. V. Wood, Superintendent West Side Belt Railway Company, Pittsburgh, Pa.

J. L. Hoof, Inspector Pennsylvania Railroad, No. 909 Lexington avenue, Altoona, Pa.

J. A. Rickabaugh, Inspector Pennsylvania Railroad, No. 608 Seventh avenue, Altoona, Pa.

B. M. Kincaid, Inspector Pennsylvania Railroad, No. 1327 Sixth avenue, Altoona, Pa.

W. K. Bell, Inspector Pennsylvania Railroad, No. 617 Kelly avenue, Wilkinsburg, Pa.

E. W. Brown, Inspector Pennsylvania Railroad, No. 619 Kelly avenue, Wilkinsburg, Pa.

Chairman: These applications have all been approved by the Executive Committee, and the applicants are therefore duly admitted to membership in the Club.

Under the head of Communications the Secretary read a number of communications: Among them one from Mr. Danl. M. Brady, of the Brady Brass Co., New York.

The communication from Mr. Brady relative to advertisement in the Club journal was on Motion of Mr. R. H. Blackall, referred to the Executive Committee.

Under the head of New Business the Secretary announced that two matters were to have been brought up before the Club at this meeting, but that the persons who were to have brought them up were absent. The Secretary, therefore, suggested the matter to the Club, as follows:

It was suggested at our last meeting, it being a smoker and no regular business being transacted, that we change the hour of our meeting, and have it in the evening instead of in the afternoon, believing that we would have better attendance at our meetings if held in the evening.

Another suggestion was that an extra assessment be placed upon the membership to meet the expense of a light luncheon at all of these evening meetings.

Chairman: Gentlemen, you have heard the suggestions made by our Secretary. The first one to come up, I presume, would be the question of the change of the hour of meeting. We would like to hear from any of you on that subject.

Mr. H. W. Watts: Mr. President: In order to bring the matter up, I move that it be referred by the Secretary to the members of the Association for vote, to be reported at the next meeting. There are not very many of us here, and on a change so radical I think we should ascertain as generally as possible the sentiment of the entire Club.

The motion being duly seconded, was put to vote, and it was ordered that the Secretary be instructed to communicate with each member of the Club as to changing the hour of meeting from 2 o'clock P. M. to 8 o'clock P. M.

A member: I suggest that we ascertain from the hotel proprietor whether the change would be suitable to him.

Chairman: The motion is carried, and it is so ordered.

What is your pleasure in regard to taking up the matter of an additional assessment in connection with this at the same time? I believe that could be embodied in the same notice.

On Motion of Mr. D. J. Redding the Secretary is instructed to refer this matter to the members in the same notice with which the other is given.

Secretary. Mr. President: There is another matter that suggests itself to me that I think it would be well to take some action on at this meeting. As is known to the members of the Club, our Journal is not yet entered at the Post Office as second class matter, and we have to put the regulation amount of postage on each copy. We would have quite a saving if we were to change our By-Laws to read $1 for membership fee and $1 as a subscription to our journal of proceedings. Of course it will be understood that does not increase the total dues but simply makes a division of the $2, $1 to apply on subscription and $1 to apply on membership fees. Under the regulations of the Post Office Department we could then be entered with the privilege of second class mail matter. If it be the desire of the Club, we might include that also with the other matters to be referred by circular to the members of the Club.

Chairman: Gentlemen, you have heard the remarks of the Secretary, what is your pleasure.

Mr. Watts: It is customary on some magazines to have a price printed on the cover to outsiders, and still have it free to members. Couldn't that be done in this case?

Secretary: We have a price printed already of 20c a copy to outsiders. But in order to overcome the postal prohibition against advertising schemes we would have to have 50 per cent. or more of the membership bona fide subscribers. So it would be necessary to change the By-Laws.

A member: What is the provision of the Constitution for a change, a two-thirds vote?

Chairman: "Amendments may be made to the By-Laws by written request of ten members presented at any regular meeting and decided by a two-thirds vote of the members present at the next regular meeting."

Mr. R. H. Blackall: Under these circumstances it might be well to propose this subject now and inform the members that it is going to come up at the next meeting. Therefore

On Motion of Mr. Blackall the Secretary is instructed to notify the membership in the same circular letter to be used for the previous matters, that this proposed change in the Constitution will come up for action at the next meeting. Also that a written petition of ten members be immediately drawn up and presented at this meeting, to comply with the requirements of the By-Laws. This was accordingly done.

THE CHILLED IRON CAR WHEEL.

BY C. V. SLOCUM,
PRESIDENT KEYSTONE CAR WHEEL CO.

No portion of the equipment used in operating a train, probably excepting the locomotive itself, has been developed to such an extent as the chilled iron car wheel, in point of strenth and durability.

The manufacturer who makes such a statement is popularly supposed to be "blowing his own horn," but the improvement is clearly demonstrable. Back as far as the year 1888, the chilled wheel in freight service was expected to run three years, and was guaranteed for that length of time, under cars with a capacity of 30,000 to 40,000 pounds.

Tests and inspections of wheels were practically unknown. Car wheels were supposed to be all right, because the manufacturers thought they were, like a recent cartoon in "Life," in which the proprietor of a certain magazine was made to say that his magazine was the best in the world, he "knew it, because he made it himself." In the early days little was known or cared apparently for the comparative strength of metals or their analyses. When the drop test was first instituted, wheels were frequently known to fail to meet the requirements of five blows. Test wheels were even said to have broken of their own weight when thrown flat for the test ; test bars were "good enough" if they broke at 1,800 to 2,000 pounds, transverse strain. To illustrate the improvement in strength of car wheel iron, as shown by test bars made from the same identical iron, the writer has brought here to-day some bars which have withstood 3,500 pounds transverse strain without breaking. These we will test again this afternoon, and expect them to withstand the same load the second time before breaking.

These bars, as you will note, are twelve inches long by one inch square only. In this connection a statement was made in the Pittsburg papers within the last thirty days, that the average tensile strength of cast iron wheel is 22,000 pounds. The mean tensile strength of American iron, as determined by Maj. Wade for the U. S. Ordnance Corps is 31,829 pounds. Greenwood gives it as 45,970. In a general way it may be safely stated that good car wheel iron will develop 50 to 150 per cent. greater tensile strength than ordinary cast iron, and can be and is made to closely approximate the strength of puddled steel quoted by Mr. Kirkaldy at 62,720 pounds, as the result of many experiments, while the Society of Civil Engineers (England) gives the tensile strength of Bessemer steel as 76,653 pounds.

To meet the constantly increasing demand for wheels which will carry at least double the maximum load permitted six years ago, the up-to-date car wheel foundry has found it necessary to give particular attention to mixtures ; to the grading and analysis of different irons used ; to uniform shop practice ; to careful inspection of the finished product, etc. Much interest has developed in the experiments made at Niagara Falls last year, and again this summer conducted by Mr. A. J. Rossi, C. E., in the electrical smelting of titaniferous ores. Iron containing titanium is known to be of great value in car wheels, having the effect of hardening the treads and strengtheng all parts of the wheel, including the plates, but the real or imaginary difficulty of smelting titaniferous ore has prevented its general use up to the present time. Mr. Rossi, however, has been indefatigable in developing this element. The writer has a letter under date of September 5, 1902, from Mr. Rossi, in which he states "all the objections against titaniferous ores seem to have been destroyed one after the other. In a number of experiments I have melted in a crucible a great number of mixtures with various fluxes at temperatures below those attainable in a blast furnace.

"As you can remember, the slags at Buffalo contained from 30 to 35% titanic acid. We have used all the ore we had at Niagara Falls and have a good supply of white pig and titanic pig on hand. Analyses shows from .30 to .70 silican with sulphur as low as .047, and phosphorus below the Bessemer limit. Both ores contain carbon in combined and graphitic state, although in the white pig it is nearly all combined."

Our own experiments with the metal demonstrate that titanium in iron gives greater density to the metal, surprisingly increases transverse strength and gives a harder chill or wearing quality in the wheel. This is no light statement when it is remembered that the tread, or wearing surface of a car wheel, is already harder than steel—in fact a rough section of chilled car wheel iron will cut glass.

That the manufacturer will be called upon for still greater efforts may be readily believed when we read that the German Society of Mechanical Engineers has offered a prize for an engine and train that shall be able to maintain for three consecutive hours a speed of 120 kilometers, or 74½ miles per hour. It is proposed to encase the train from pilot to rear platform in a sheath of steel to reduce air resistance, the sheath to be jointed to secure flexibility and so constructed that there shall be no projecting irregularity like a window casing, to catch the resisting air.

Efforts to develop greater speed, or to carry heavier loads, have nearly always been successful in the end, with the exception, perhaps, of the flying machine. It may be believed, therefore, that the announcement on September 2d of the contemplated organization in Pittsburg of a five million dollar corporation to build cars with a carrying capacity of 190,000 pounds is an indication of the trend of the times, even though roads, culverts and bridges must be rebuilt to accommodate such loads.

The clearly demonstrated practibility of supplying in one casting a wheel with a hard tread for wear and a soft hub for machine work, with strength only limited by the price which the purchasing agent is willing to pay for it, makes the chilled cast iron wheel stand forth as its own probable successor in carrying the heavy traffic of the future. To increase the incentive for making good wheels, and to follow that up with still better wheels, a system could be, and I think should be, devised whereby a premium for additional mileage would be allowed to the manufacturer, or a proportionate increase in selling price be paid for increased strength and higher grade material, as developed and demonstrated by tests arranged for the purpose.

Suppose, for instance, that the wheel now making 60,000 miles could as readily make 100,000 miles if a reasonable percentage were allowed the manufacturer for any mileage made above the 60,000, thus justifying the use and enabling the wheel maker to use, the more expensive materials necessary to attain the increased mileage.

Assuming that it costs a railroad not less than $3.50 to replace a wheel, including the differential between the value of the old wheel and the price of the new wheel, and including the labor involved in the replacement, why should it not be more economical to pay, say 50% of this differential to the manufacturer and obtain nearly, if not quite, 100% more mileage?

Again, if ten blows are a safe limit in the drop test, why not allow the manufacturer a percentage for his efforts if 20 or 30 or 50 blows are obtained, and by the same token allow him something if a wheel supposed to stand two minutes in thermal test stands it for three or five or ten minutes?

All of these results as to increased number of blows and longer time in thermal test are obtained every day in experimental work, but it cannot become common practice until existing conditions are modified and consumers awake to the possibilities open to them.

Chairman: The next thing on the programme is the discussion of the paper presented by Mr. C. V. Slocum. And I will say that the Secretary has been disappointed in not being able to get present here, the members who were to open the discussion of this paper. This is a matter that we all regret very much. In the absence of these members I believe it would be well to call on Mr. Slocum to open the discussion.

Mr. C. V. Slocum. Mr. President: It may be a little out of order to expect me to be first to discuss my own paper, but perhaps better that way than not at all. There might not be anything left for me by the time others got through.

Possibly we have threshed out the car wheel question. This is not the first paper we have had on the subject.

I have an explanation to make in connection with the paper. It states something to the effect that certain test bars would be broken this afternoon. Of course that referred to the day when the members were out at our works, and we expected to perform the autopsy at that time. But owing to the unavoidable delay in the special street cars that we ordered those bars are still in our office. They can be broken and will be at any time when any one interested in the subject cares enough about it to wish to see it done.

There are a number of interesting things in connection with the car wheel business, also the cast iron business in general, such as, for instance, "molecular annealing." We have upon occasion taken small wheels and put them in a tumbling mill and revolved them and given them a shaking up, which has the effect of readjusting the molecules in the iron and making it stronger. I had at one time some data on the question of the increase of strength by that process, and for castings made with a moderate grade of iron something like 15 to 18 per cent. of increase of strength was obtained by that very simple process.

Quite recently a gentleman called upon us with a patent process for what he called "treating" car wheels or any casting that would have a strain resulting from the manufacture, as some car wheels are known to have. The process as I understood it was nothing more nor less than re-heating the casting by a system of flues with natural gas heat or oil heat or something of that kind, forced up through flues and down through the center, which can easily be done with car wheels because of the opening in the hubs. This practice was employed by the old Whitney Car Wheel concern in Philadelphia 40 years ago, so that while it is not new it is still sufficiently unknown for the party to have been able to get a patent on it.

It has remained for the Pittsburgh and Lake Erie Railroad Company to take a step in advance which my associates and myself have advocated for a number of years, that the car wheel manufacturer be allowed to draw somewhat upon his own experience and furnish car wheels to the trade based upon lines which his experience or his studies would seem to show were better lines. It is a well known fact that every large railroad has ordered its car wheels for years based on lines which it has specified. If the manufacturers vary 1-16 of an inch from those specifications—and the railroad finds it out—all the wheels which they have made are condemned and rejected. The Pittsburgh and Lake Erie recently sent out inquiries for prices on 8,000 car wheels to be made according to the specifications of the manufacturer, and I want to pay tribute to the Pittsburgh and Lake Erie for such a precedent. It stands alone. With the exception of the few people who order a dozen or 50 wheels and perhaps want them to fit certain axles (and that is about all they specify about it,) it is the only inquiry of that kind that has ever come to my notice in an experience of fifteen years in the car wheel business.

In the matter of making wheels for cars of 100,000 lbs, capacity, which has been touted as the great stumbling block over which the cast iron car wheel is to go to pieces, the manufacturers have of late been allowed a little more discretion. They have been compelled to meet two very severe tests: the 140 lb. hammer falling 12 feet, with which you are all familiar and the thermal test, which was illustrated at the meeting next to the last, where a band of molten iron 1½ inches thick is poured around the tread of the wheel and the wheel must stand the tremendous expansion resulting from that strain for two minutes without cracking through the tread. Some of the roads still go so far as to say that even after subjecting the wheels to these tests the manufacturer must guarantee that his product has been made up to certain other limits and must make thousands of miles in service. The idea is gaining ground however to accept wheels without guarantee when they pass successfully the severe tests mentioned.

The subject of steel wheels has been largely discussed. I think it would be very interesting if we could get some of the manufacturers or those interested in steel wheels to read a paper before this club so that we could get at more facts than a competitor would be likely to give even if he had them. It is a well known fact that certain Pittsburgh parties are interested, or about to become interested, in the manufacture of solid steel wheels. Mr. George H. Fowler secured a patent on a solid steel wheel fifteen years ago. The patent has therefore about two years yet to run. The wheel is in use under a few passenger cars. There are in round numbers one and a half millions of freight cars in service. The number of passenger cars in comparison is very small. The only cars under which steel wheels are used are passenger cars and more particularly sleeping coaches. I was told by the Master Car Builder of one of the largest roads in the United States not long ago that exactly 45 cars on his line were equipped with steel tired or steel wheels; all the others were chilled iron. The point I make in that is simply that the wheel in use is the chilled iron wheel, not the steel wheel or the steel tired wheel.

And when we cast about for results in service we are looking for the service of the chilled wheel. There are many reasons for it. The chilled wheel can be sold to-day, 600 lbs. for less than $12 delivered at the shop of the road using the wheel. The steel wheel, or steel tired, sells for not less than $36. We are asked sometimes about the paper wheel. The paper wheel as such does not exist. There is a wheel made which has a steel tire and a papier mache center. They are only used under sleeping cars, and because they are supposed to make less noise at night. (I suppose they make just as much noise in the day time but it does not make so much disturbance!) The steel wheels, or steel tired wheels, therefore, make a very small, an exceedingly small percentage of all the wheels that are in use. . The subject is so large and the interest in it is so great and the money investment is so heavy that the manufacturers of the chilled wheel will be found to be not only progressive but up to date in the matter of supplying a product which will meet the requirements under these tremendous loads which are now being carried.

This paper mentions the formation of a company, announced in the Pittsburgh papers only a few weeks ago, to build cars with 190,000 lbs. capacity. When a similar announcement was made of 100,000 lbs. capacity cars it was laughed at; the railroads would have to rebuild their culverts and bridges; it could not be done, etc. One road did do it, and the others had to. If one road takes up the 190,000 car it is fair to assume that the others will come to it.

A car with a load capacity of 100,000 and an excess limit of 10,000, or 110,000 pounds of load, requires a very strong wheel. And it is a very curious fact that there is not one defect which is found in the chilled iron wheel in that service that is not also found in the steel tired wheel. An instance came to my notice within a very few days where our representative happened to see a lot of 42 and 44 steel tired wheels, every one of them with the longitudinal seams, developed in this very heavy service. The reason for the seam in chilled wheels is very simple, and it is almost exclusively due to the fact that while the railroads had increased their load from 60,000 lbs. up to 110,000, and their axles that carried that load from about 400 to about 800 lbs., and put in steel bolsters instead of wooden ones, and all that sort of thing, the roads which first put in the chilled wheel in that service increased the weight of the wheel from 600 to 650 lbs., or less than 10 per cent. The P. R. R., which has used so many of the heavy steel cars, has now increased the weight of their wheels from 630 to 700 lbs. Mr. McConnell, the president of the Railway Club, made the statement at a previous meeting, that the Union Pacific Railroad used a 750 lb. chilled wheel, and we know from very careful investigation of the results in many instances that when given the opportunity of supplying the proper wheel, the chance to supply the proper material and obtain the price for it, it will and does meet the requirements. The question then which the railroad authorities have to decide to-day is whether they will use a steel or steel tired wheel at $36 and upwards, on which there is comparatively little rebate when the wheel is worn out, or use the chilled wheel at $12.00, worth even when worn out over 60 per cent. of its first cost. The steel wheel and the chilled wheel should have, as scrap, about equal value. For years it was the custom of manufacturers of chilled iron wheels to take an old wheel back and furnish a new wheel for $3, the old wheel being part payment for the new one. It can be done to-day at from $3.50 to $4, so that when we come to look at this question of the millions that would have to be invested in steel wheels to replace the iron ones (and we are continually threatened with that), one question which will have to be fought out is how long will it take to get the officials of the roads up to the point where they are willing to pay $30 for wearing out a wheel, instead of paying $5 or $4.

Chairman: Gentlemen, I do not feel at all sorry that I called on Mr. Slocum to open this discussion. I think he has done it admirably. But there is one matter in connection with his remarks, and that is in connection with the P. & L. E. asking for figures on wheels of the manufacturers' specifications. Now, there must be something that has caused the P. & L. E. to do that, and as we have two members of the motive power department of the P. & L. E. here, I believe it would be interesting to get at that side of the question. We, I am sure, would like to hear from either Mr. Redding or Mr. Carson.

Mr. Redding: It will not take long for me to tell what I know. I am not in the car department, and therefore I do not know.

Mr. Carson: All I have got to say is that we have got an abiding faith in the manufacturers of chilled iron wheels.

Chairman: Before we came up here I was talking with a prominent representative of a railroad here, and the question of cast iron wheels was brought up, and he said he did not have anything to do with the manufacturing, what he had to contend with was the service. Possibly he could give us something.

Mr. F. R. McFeatters: Mr. Chairman, I do not know that I could give you any information on the subject that would be of any use to the members present. You have already all been through what I have on the wheel question. As Mr. Slocum mentions, the longitudinal seam appears to have been the question and the whole cause of the trouble, and the trouble developed that way.

Chairman: Does any other gentleman have anything to say on this subject?

A Member: It may be interesting to the members to know that the Bethlehem Steel Co. have made a machine, in fact two machines, one a punch and the other a rolling mill, for punching solid steel wheels and flanges, the puncher punching them and the rolling mill rolling them. They have done something already and I think they have turned out some wheels, but as for the service of course that is another question.

Mr. Slocum: I would like to say that as far as I am personally concerned I am very much interested in seeing the steel wheel developed. We have not the slightest objection to having the steel wheel a great success. I met a gentleman just before coming in here to-day who informed me that he had seen the first wheel made by the wheel machine that this gentleman speaks of. He said it was very handsome, that it looks very much like a chilled iron wheel! As far as appearance goes it was very satisfactory.

But there is a very important point involved. That wheel must be sold for more money than the chilled iron wheel will be sold for, and it draws immediately our competition. A competitor who charges a higher price creates a tendency to an increase in the price by others. When we have not to go so low in price to meet competition, we have a better competitor. Every man in this room who has to go out and sell goods knows what it is to compete with people who sell good goods and ask high prices. If they can sell their steel wheel for $25 or $30 the manufacturer of chilled iron wheels can sell his wheel for say the modest figure of $15. Roads may prefer those steel wheels under passenger cars because of the fear some officials have that the public will think they are using something that is cheaper than necessary. It is not because the application is not all right, but because they think they have bought something cheap.

We are up against the question every day in going in to take an order, "Your price is not low enough." If it comes to a question of $25, as against $15, it will be necessary to drop that argument.

Chairman: Does any other gentleman have anything to say? This is an important subject and we would like to hear from the rest of you.

A Member: Probably Mr. Slocum can help me a little on the subject of longitudinal seams in a cast wheel. We sometimes find them in a wheel after it is broken, but did not detect it in making the general inspection of the wheel. It is probable that they were defective sometimes.

Mr. Slocum: The longitudinal seam is popularly supposed to be caused by weakness in the material. Experiments which we have made demonstrate that it is caused entirely by burning. If you take a wheel and put hot metal around it in a similar manner to that in which the thermal test is made, you will find small blisters at intervals of about an inch and of about the size of a nickle or a silver ten cent piece. The hotter the wheel becomes the greater the tendency of these burned spots to meet each other by a crack. And wheels removed from service which show the longitudinal seam show the burned spots, and show that by constant heating and cooling the spots have gradually met each other and caused a seam which runs parallel with the tread or flange of the wheel.

When the seam forms there is no hope for that wheel, because it makes a defect the same as a crack in any material. And the first severe strain, on a curve or by binding or in some similar manner, the flange is crushed off. The methods employed to protect it are a reinforcement of the root of the flange, which has the same effect on the wheel that the muscle on the upper part of the arm has in a man. It is generally supposed that the weakest spot in the arm is at the wrist, where the section is the smallest. Nevertheless, a man lifts his load and carries his strain with that thin section, provided he has the muscle in the shoulder and back to carry it. We have endeavored to reinforce the wheel in that same way at the root of the flange, and by changing the mixtures, improving the combinations, getting a more homogeneous product, we believe we have solved the question. I do not say it for our company alone, for other manufacturers are doing the same thing. We may reach it by one process and they by another, but we are all working for the same end. And we do know absolutely that wheels made within the last year or year and a half, perhaps, used in this severe service are standing the strain, getting the mileage and proving satisfactory to the consumer.

The Same Member: I agree with Mr. Slocum in that and I want to say that the wheels I referred to are not any of them Mr. Slocum's wheels. They were cast in 1896, and to my knowledge—I know the manufacturer, but will not mention his name—there have been perhaps half a dozen wheels that failed under the 100,000 lb. capacity cars, and in almost every case we found that the flange was split off from the wheel, and it ran from 18 to 24 inches in length, and in examining the wheel it showed where there had been the longitudinal seam. Of course, it had a dark appearance, and probably had been burned, as Mr. Slocum says, but I asked that question because I was not altogether clear about it.

Mr. H. W. Watts: I would like to ask Mr. Slocum what he thinks is the best method of detecting the longitudinal seam, or if there is any seam. I have in my office now, a piece of flange about 6 inches long which was brought in a few days ago taken from a wheel under one of our hot metal cars. The flange was broken off and the car ran about half a mile across our hot metal bridge, the wheel being up to that time on the inside of the curve, and it was derailed at the south end of the bridge. The flange presents something the same appearance as Mr. Slocum has mentioned, looking as if it had been burned for about a half inch deep, having a bluish cast like burned steel. But if it was burned it was likely by the hot metal flowing over and dropping on the wheel.

Mr. C. V. Slocum: Naturally, the manufacturer's opportunity of investigation on a matter of that kind is limited. He only ascertains that the longitudinal seam has occurred when the wheel with a seam in it is shipped back to him. We find in examining scrap wheels for seams that it is necessary to use a microscope, which of course would not be very available to a car wheel inspector on a railroad. I have seen a wheel where the crack was so very fine that the naked eye would scarcely discover it, although having once located it with the microscope you could follow it. The reason, of course, is that it occurs when the wheel is hot from the brake and opens up and as it cools closes again. I imagine your car wheel inspector could give you more points on that than I could.

Mr. J. D. McIlwain: I would like to ask a question. What proportion of the passenger equipment of the country outside of the Pullman cars, are equipped with steel or steel tired wheels in proportion to the number of chilled iron wheels used?

Mr. C. V. Slocum: The use of steel tires varies according to the practice of the railroad. One of the large railroads in the East had a Superintendent of Motive Power some five years ago who would have nothing else but steel tired wheels under his passenger equipment. His nearest and dearest competitor had but very few. You "pays your money and you takes your choice."

The roads entering Pittsburgh I think without exception use some chilled iron wheels under their passenger equipment. I think none of them use them exclusively, nor do I think they would use chilled iron wheels at all for carrying human freight if they did not think they had as good, strong, serviceable a wheel under their car.

The question of percentage is guess work. I should say about 30 or 40 per cent. are steel tired.

Chairman: If you will permit me, I would like to say a few words on this subject of longitudinal seams. I have had a great deal of experience in that direction, especially some years ago when I was with the P. & L. E. At first I was inclined to the opinion that the number of accidents due to broken wheel flanges was caused by a lack of proper inspection, and for that reason I went into it pretty closely. But after examining a number of cases I concluded that in fully 90 per cent. of the breakages it was almost impossible for an inspector to detect longitudinal seam. I remember one instance where a wheel had been in service for over four years and the flange was worn and the tread worn hollow near the throat of the flange, and the flange broke off. We would find this difficulty that the seam would appear to be anywhere from three, to I have seen them as high as 19 inches long, that there was not any portion of that seam that could be detected with the naked eye. I found that a scale had apparently continuously covered the seam, and from the fact that it was of a burned color without any indication of dust or anything of that kind having penetrated the seam, I concluded that it had been covered so that it was impossible for an inspector to detect it. Mr. Carson, I think, can verify those cases. I want to make these remarks merely to say to Mr. Watts that I don't think he ought to be too hard on his inspectors until they can clearly show that the man has been negligent. I feel the inspector is not entirely to blame, that at times neither he nor any one else could determine that a wheel had a seam.

Mr. Carson: For Mr. Watt's benefit I want to say on the same subject that some time ago we had a case where there was 18 or 20 inches of flange broken off and it was due to longitudinal seam. Now, in order to see just how much further that seam went, we followed it very closely around the tread of the wheel to see if there was any indication at all of the seam, and there was not. Then we got a sledge and commenced to knock off part of the flange, and we knocked off, I suppose, about six more inches, and that seam still continued, covered, as Mr. Simons says, with a scale so that you could not detect it.

Mr. C. V. Slocum: I want to be heard once more on this question. You stated in your remarks, Mr. Chairman, that the flange wore thin in four years and the seam developed, and then the flange would strip off. It is contended by very many railroad men and by practically all car wheel manufacturers that very little trouble can ever be experienced from car wheels of any description in service where they are removed before the flange wears sharp or thin. It is a pretty well established fact that a car wheel will run about 10,000 miles for each 1-16 inch of wear. And when the wheel has worn down ¼ inch—and many of them wear ½, and I have seen wheels worn down so far that there was no chill left—yet if that flange should strip off after all that service you would say it was a poor wheel and the manufacturer was to blame. Manufacturers are beginning to refuse to guarantee wheels with sharp flanges, which is a flange that is worn thin. The reason is very plain; a thin flange is not as strong as a full sized one; it is not safe in service, and the inspector who allows a wheel to continue in service after the flange is worn thin is the man who takes the lives of passengers in his hands; it is not the manufacturer. Careful inspection and the removal of the wheels when worn a definite amount; wear which indicates that the wheel ought not to be safe even if it is; that is the time to remove the wheel.

Chairman: In the case of the longitudinal seams I have seen it has not always been where the flange was worn so.

Another feature is that the Master Car Builders' rules define the limits and it is taken out of the inspectors' hands entirely.

Mr. C. V. Slocum: That is according to the rule. But you know, as a man handling men, that the man who carries your template which tells that a flange is thin is not the man that always takes the necessary steps. It is the personal equation. How is any sort of inspector to know instantly when a flange is worn out? Sometimes those cars go out and they are not inspected by the man who ought to inspect them for a year.

Mr. J. D. McIlwain: Hasn't the thin flange got a good deal to do with the longitudinal seam?

Mr. C. V. Slocum: If the President would like me to answer that, the thin flange has not much to do with the longitudinal seam. It may have been before you came in that I explained that a wheel in service frequently becomes burned by friction, and when that burning happens is when the mischief occurs. A crack is formed by the heat expanding the metal, afterwards it cools and the process is repeated perhaps a dozen times that day, and finally it reaches a point that it can't come back to normal conditions again and it pinches off. Wheels sometimes come into Altoona down the mountain red hot, and if a crack starts then it will never weld again. The subject of defects and damage to wheels in any direction is very much like the entire railroad business, it means eternal vigilance. Good car wheels will not form seams in fair service; poor car wheels sometimes will. Good car wheels do not break in fair service; they will not always stand running off the track and bumping over stones and bridge abutments. But I have never known of a case if car wheels were made upon honor and of good material and faithfully inspected, with a man at the head of the foundry who knew his business and insists upon his system being followed up, where wheels would break. It is where the purchasing agent wants to save 25 or 50c—and he can do it every day. Manufacturers do not wish to make any wheels unless they make good wheels, as they take human life in their hands every time the wheels run, for there is at least a brakeman on every train. Nine out of ten manufacturers would prefer to make good wheels if they can, and will make them if they know how. Imagine some railroad superintendent walking into your office and saying, "We had a broken wheel on our road yesterday that killed a man. You made that wheel." I do not know of a manufacturer who has ever had that thing said to him. I think that is the greatest tribute I can pay to the car wheel manufacturers to-day. Longitudinal seams have been practically wiped out of existence in chilled car wheels in the past year. To overcome a defect of that kind you have first to learn something about it. It came upon the manufacturers like a flash out of a clear sky. 100,000 lb. cars had never been used before, and it was not the correct weight of wheel that was used. They increased the weight 50 lbs., which is about 8 per cent. The railroad men themselves found out that that wheel was too light. The P. R. R. have changed their specifications within a year. They now require 700 lb. wheels, where they formerly took wheels which must not weigh less than 590 or over 630 pounds. The increase is a step in the right direction.

A Member: Is it customary to keep a record of wheels that they give a thermal test to see if there is a greater percentage of those wheels that have longitudinal seam than those that are not subjected to the thermal test?

Mr. Slocum: I think that is a misapprehension of the methods of the manufacturer. In supplying car wheels we say the wheels are subjected to the thermal test and the drop test. When you sell 100 wheels you present 103 to the railroad inspector. He goes through the 103 and selects any one up to three that he cares to select, and he chooses any wheels that he thinks weak or defective or anything which might cause trouble when the wheel is in service. In other words, he tries to pick out the weakest wheel, because if the weakest wheel stands the test the others, it is assumed, are all safe enough for service.

One wheel is subjected to the drop test and two wheels to the thermal test, and those three wheels before the inspection is done are broken up and never go into service. It is the 100 wheels (that are never actually tested, except by proxy) which go into service.

A record is kept of every wheel which is made. All reputable car wheel manufacturers are able to identify their wheel. There is a record of the date the wheel was made, the moulder who moulded it, the part of the heat in which it was poured, and the pattern from which it was made. But we have no record of what a wheel does in service, unless by chance it happens to fail to make its mileage. All such information is kept in the railroad office records.

Mr. D. J. Redding: I would like to ask Mr. Slocum why it is if the longitudinal seam is caused by over-heating, that the seam only extends from six to ten inches; why doesn't it go all around the wheel when the wheel is heated equally all around?

Mr. Slocum: That is a more difficult question. There are vagaries in metals as there are in men, and a wheel sometimes has a weak spot, and when there is, the brake shoe is pretty apt to find it. The seam could generally probably be found all the way around the circumference of the wheel if the fracture or heat continued the same around the wheel. The portion of flange which comes off is due perhaps to the fact that the wheel has at some time been slid along the rail and the seam begins to develop at that point at that time, then when it is heated the next time, it receives more strain, and acts the same as any other metal which has cracked, it never heals.

Chairman: If there is nothing further we will close the discussion.

Meeting adjourned.

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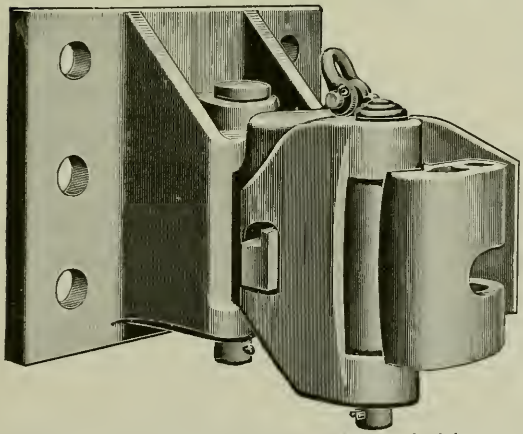

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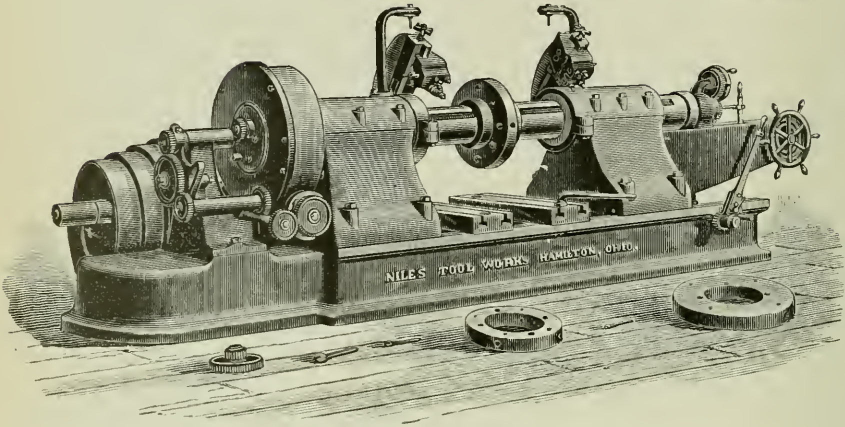
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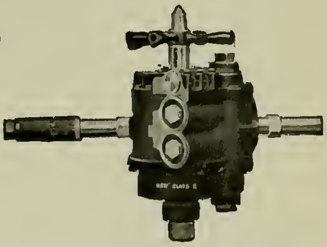

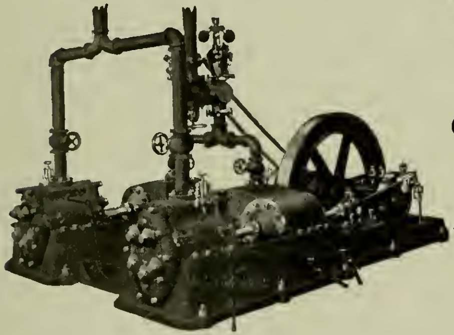

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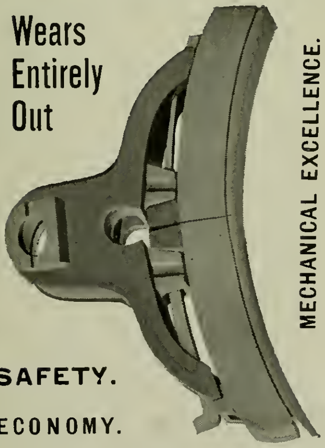

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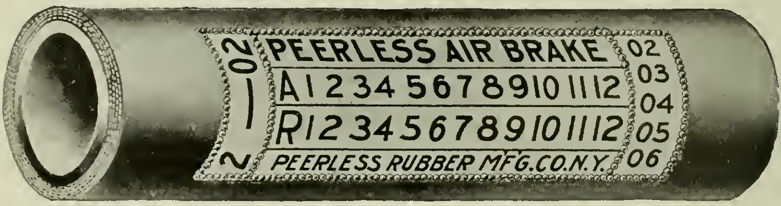
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06

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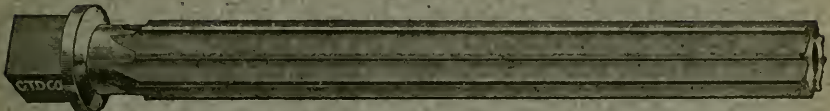

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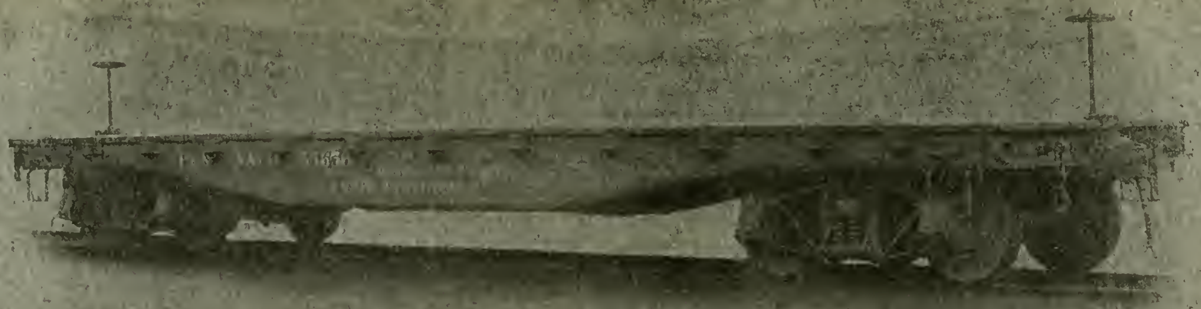

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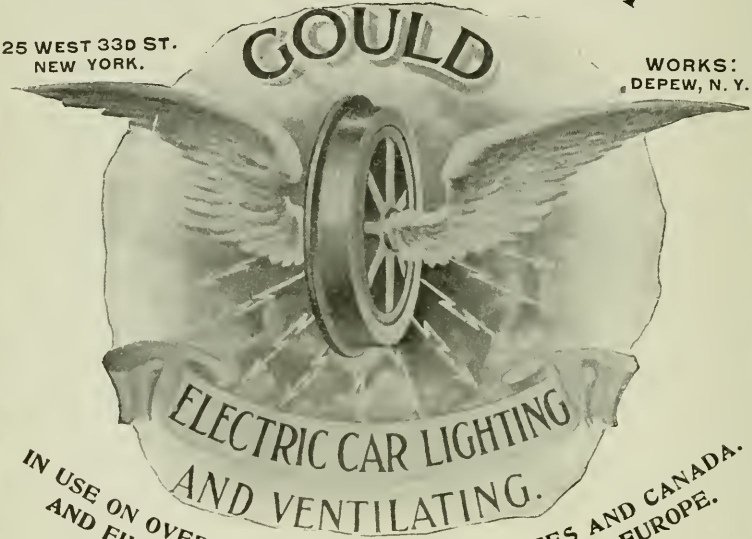

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Friction Draft Gear.

The Westinghouse Friction Draft Gear is a gradually applied and automatically released frictional resistance which absorbs the shocks delivered to train during buffing and pulling operations. . . . .

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Builders of the Air Brake.

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FOR REMOVING TIRES AND CRANK PINS.

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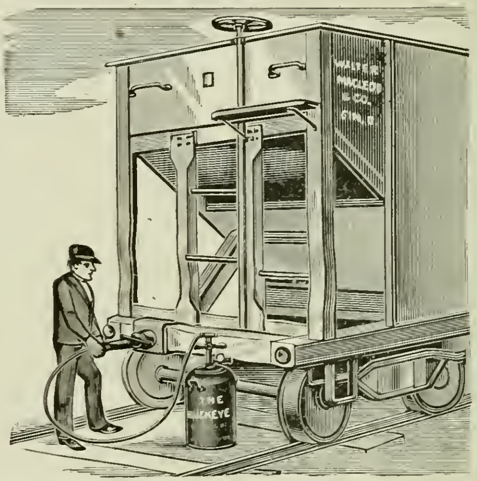
Bending and Flanging Large Pipe.



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208 THIRD AVENUE, PITTSBURG.

OFFICIAL PROCEEDINGS
of the
Railway Club *of* Pittsburgh.

ORGANIZED OCTOBER 18, 1901.

OFFICERS, 1902 - 1903.

President,
J. H. McCONNELL,
Manager American Locomotive Co., Pittsburgh, Pa.

Vice-President,
L. H. TURNER,
Supt. Motive Power, P. & L. E. R. R.
Pittsburgh, Pa.

Treasurer,
J. D. McILWAIN,
Sales Agent, J. D. McIlwain & Co.,
Pittsburgh, Pa.

Secretary,
J. D. Conway,
Chief Clerk, Supt. M. P., General Offices P. & L. E. R. R, Pittsburgh, Pa.

Executive Committee,

D. F. CRAWFORD,
Supt M. P. Penna. Lines West of Pgh,
Ft. Wayne, Ind.

J. E. SIMONS,
Treasurer Hunt Foundry and Machine Co.,
New Kensington, Pa.

F. T. HYNDMAN,
S. M. P., Bflo, Roch. & Pgh. R. R. Co.,
Du Bois, Pa.

Vol. II.
No. 2.
Pittsburgh, Pa., December 26, 1902.
$1.00 Per Year.
20c. per Copy.

Published monthly, except June, July and August, by the Railway Club of Pittsburgh,
J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
DECEMBER 26, 1902.

The meeting was called to order at 2 o'clock P. M. at the Hotel Henry, Pittsburgh, Pa., with President J. H. McConnell in the chair.

Railway Club of Pgh
8

The following gentlemen registered:

MEMBERS.

Anderson, Thos.
Brown, Jno. T.
Conway, J. D.
Ford, D. W.
Francis, Jno. S.
Gilbert, E. B.
Holbrook, D. O.
Howe, David M.
Hukill, J. L.
Hunter, R. F.
Hyndman, F. T.
McConnell, J. H.
McFeatters, F. R.
McIlwain, J. D.
Noble, D. C.
Porter, Chas.
Postlethwaite, C. E.
Rank, O. P.
Richardson, W. P.
Slocum, C. V.
Slocum, A. W.
Synnestvedt, Paul.
Turner, L. H.
Wright, R. V.

VISITORS.

Blair, A. C.
Davis, T. R.
Milliken, I. H.
Smith, S. B.

The minutes of previous meeting being printed, the reading of them was dispensed with.

Secretary Conway read the list of names of applicants for membership in the Club, as follows:

Orrin Fitzgerald, Draughtsman, Pittsburg & Lake Erie Railroad Company, General Office, Pittsburgh, Pa.

Wm. J. Post, Auditor, Union Railroad Company, Carnegie Building, Pittsburgh, Pa.

Edgar S. Low, President and General Manager, Edgar S. Low & Co., Empire Building, Pittsburgh, Pa.

Thos. R. Davis, Representative, Wisconsin Graphite Company, Wilson, Pa.

J. L. Hurley, Draughtsman, General Office, Pittsburgh & Lake Erie Railroad Company, Pittsburgh, Pa.

Harry Vissering, Superintendent, American Locomotive Sander Company, Great Northern Building, Chicago, Ill.

Hiram J. Slifer, General Superintendent, Chicago, Rock Island & Pacific Railway Company, Chicago, Ill.

E. W. Summers, Structural Engineer, 312 Arlington street, Youngstown, O.

C. O. Orchard, Superintendent Shipping Department, Carnegie Steel Company, Pittsburgh, Pa.

W. B. Trainer, Assistant Superintendent, Blooming Department, Carnegie Steel Company, Pittsburgh, Pa.

I. H. Milliken, Representative, McConway & Torley Company, Pittsburgh, Pa.

A. C. Blair, Secretary and Treasurer, Youngstown Car Manufacturing Company, Frick Building, Pittsburgh, Pa.

C. A. Palmer, Bookkeeper, Youngstown Car Manufacturing Company, Frick Building, Pittsburgh, Pa.

G. H. Fall, C. C., Youngstown Car Manufacturing Company, Youngstown, O.

W. H. McCormick, Representative, Wisconsin Graphite Company, Allegheny, Pa.

President: Gentlemen, after these names have been submitted to the Executive Committee and by them approved, these gentlemen will become members in full standing in this Club.

The Chair announcing that the consideration of the amendments to the By-Laws which were duly submitted at the last meeting would be in order, the three amendments proposed were then read by the Secretary.

Upon motion, the first amendment proposed, which reads as follows: "That Section 1 of Article I., By-Laws, be changed to read 'at 8 o'clock P. M.,' instead of '2 o'clock P. M.,'" was adopted unanimously.

Upon consideration of the second proposed amendment:

Mr. J. D. McIlwain: The Secretary's method of distributing the Club funds to meet requirements, such as postage and entertainment, is to be commended. I do not see why it would not be a good idea to make the dues straight $3.00 per year, appropriating $1.00 for subscription to the club journal and an amount not to exceed $1.00 for entertainment. However, I shall favor the move in any shape it may be put.

The motion being put to adopt the second proposed amendment, which reads as follows: "That Section 1 of Article III., By-Laws, be changed to read 'the dues of members shall be $2 per annum, $1 of same to apply to subscription for club journal, payable in advance, on or before the fourth Friday of September each year." The said amendment was adopted as read.

Upon discussion of the third proposed amendment:

Mr. R. V. Wright: I hardly think it wise to make this additional assessment in quite this form. There are very few of us who can attend the regular meetings. A large percentage of our members are scattered about the country and can not be here often; and it seems hardly right to make them pay for feeding us. I would not object to it if the $1 was appropriated to cover the expense of an annual banquet, because then all of our members could have part in it.

Mr. L. H. Turner: It is every member's privilege to be present. Because most of us could not get here in the afternoon, it was thought best to have the meetings in the evenings, and a little refreshment, as is the practice in the New York Club, and possibly some others. A contribution of $1 a year is quite small, and I am sure that any of our members would not object to paying it, even though he could not be here himself, to assist in making the meetings pleasant.

The motion to adopt the third proposed amendment, which reads as follows: "That an extra assessment be made upon each member annually of $1 to provide light refreshments for each meeting," being put, was carried without dissent.

Secretary: Several meetings since, I called attention to the fact that there would be an interchange subscription privilege, among certain Clubs throughout the United States, for the various Club journals. The matter at that time was not taken up formally and acted upon. I have since had communications from some of the Railway Clubs wherein they have asked us to put them on our mailing list for copies of our Proceedings. I should like to have our Club act upon this question.

The arrangement is this, that any member of this Club desiring a journal of any of the other Clubs belonging to the Association, can procure the same at the actual cost of printing to that Club; and likewise members of other Railway Clubs are to have the privilege of purchasing from us as many journals as they may desire at actual cost to us.

Mr. R. V. Wright moved that the Secretary be instructed to interchange journals with other Clubs according to this understanding.

A Member: The Secretary could only do this through the members, as I understand it. How is that?

Secretary: The Secretaries of the different Clubs furnish the lists and pay for them from Club funds, and collect the amounts from the different members ordering the copies.

The motion to instruct the Secretary as above indicated, being put, was carried unanimously.

THE ESSENTIALS OF A GOOD DRAFT GEAR.

BY MR. E. M. HERR, MANAGER WESTINGHOUSE AIR BRAKE CO.

The term "draft gear" is frequently used to mean either the whole or some important part of that portion of a car through which the stresses, occasioned by either pulling or pushing the car by its draw-bar, must pass to the car framing. It seems, therefore, important to first define the term "draft gear."

My definition would be the broad one covered by the statement already made, viz.: The draft gear is that part of the car transmitting to the framework of the car body the pulling and pushing stresses imposed upon the draw-bar. This draft gear is composed of three essential parts.

I. The draw-bar with its yoke and followers or other means of transmitting pulling and pushing stresses to the second or yielding portion of the draft gear.

II. The yielding portion, usually a spring or substitute therefor, interposed between the draw-bar and attachments and the third or fixed portion of the draft gear.

III. The fixed portion or draft gear attachments to the framing of the car.

Having now the draft gear composed of the draw-bar, the yielding portion, and the attachments to the car, what should be said to be the essentials of a good draft gear.

This more than any other part of the car structure is subjected to severe shocks and stresses both of tension and compression. It is, therefore, manifest that great strength is of prime importance. A designer with the object of the greatest possible strength in the draft gear would make the draw-bar of the strongest possible material, see that its attachments were also of the proper cross section to withstand fully as great stresses as the bar, and that they were secured to the car framing firmly with bolts, keys, and other accessories arranged to distribute the stresses transmitted to the car sills as advantageously as possible. Such a design would leave out entirely the second or yielding portion of the draft gear because it is much easier to attach a draw-bar to the car framing directly than by interposing a spring or other yielding member between the draw-bar and the car. Not only this, but were pulling and pushing stresses only to be considered, the interposition of this spring would surely make a weaker and less secure attachment. Is this yielding portion then a non-essential to a good draft gear which can be omitted or have we failed to consider some condition affecting its design?

Slight consideration will disclose the omission. The pulling and pushing strains imposed on the draw-bar are not gradually applied but generally come as shocks or blows. It is well known that the destructive effect of a blow is greatly increased when it is delivered against a rigid body and correspondingly decreased when the thing struck is yielding. It is, therefore, clear that another essential of a good draft gear is interposed yielding resistance.

It was formerly supposed that if this yielding portion of the draft gear was equal to or slightly in excess of the tractive effort of the locomotive hauling the cars, ample provision had been made. Were the strains imposed upon draft gear never greater than the tractive power of the locomotive drawing the train, a yielding portion of the draft gear equal or slightly in excess thereof would be sufficient. Unfortunately for the simplicity of our design, this is not the case. Owing to the enormous weight of modern cars and locomotives, these bodies when once set in motion have in themselves, by reason of such motion, an amount of energy or capacity to exert strains and stresses in their draft gear compared with which the tractive power of the most powerful locomotive is small. Witness the ease with which trains are often broken in two, three or more parts in passing through sags or over "hog backs."

The forces which cause this damage are not gradually applied on the draft gear. They usually come as blows caused by bodies of great weight moving with moderate velocities. In fact the weights of modern cars and locomotives are so great that unless the speed with which they come together is moderate, no draft appliance even with the greatest possible amount of yielding resistance interposed, can withstand the shock. In fact, as instanced above, their strength is sometimes exceeded usually because of yielding resistance of inadequate capacity.

It is of great importance to keep carefully in mind the difference in effect produced by the impact of bodies moving with different velocities. We are as likely to reach erroneous conclusions in designing draft gears if we reason from the effect of impact from bodies of too high as of too low velocity. Not only, therefore, is the yielding portion an essential part but it is so essential that no draft gear without it could long endure. It is also evident that the amount of yielding resistance formerly adequate becomes entirely inadequate with the heavier cars and locomotives and the stronger and more rigid car bodies now used.

Can this greater yielding resistance be obtained satisfactorily by simply increasing the number or strength of the springs formerly used with good results? Within certain limits only can this be done, for it must be remembered that when a spring is compressed it contains an amount of stored energy capable of doing work or increasing stresses in the parts confining it just as surely as the moving body of the car or locomotive itself. The strains these springs are able to and do exert are practically equal to the force which compressed them. Inasmuch as cars must be run in trains, where the draft springs act one upon another the cumulative effect of the recoil of a number of such powerful springs cumulating at some point in the train, would result in stresses so high that the other parts of the draft gear could not withstand them even if such stresses were not increased, as they often are, by the power of the locomotive drawing the train. This action often results in the breakage of couplings when long trains especially of empty cars are stopped at high speed by an emergency application of the air brake.

It is, therefore, essential not only that the yielding portion of the draft gear be of large capacity but that it should have little reaction or recoil.

Now, having the strongest possible draw-bar properly arranged with an adequate amount of yielding resistance with minimum recoil, the third or fixed portion of the draft gear should be made of the strongest available materials and secured to the sills of the car in such a way as to bring the heavy strains of pulling and the still heavier buffing stresses upon the parts of the car best adapted to receive them.

No specific rules can be laid down as the design of cars is so different that the disposition of these attachments so the various stresses come on those parts of the car which can best resist them, is the great essential. It is also essential that the draft gear attachments, or the so-called fixed portion should be so designed as to admit of proper inspection and facility in making repairs or renewals.

The essentials of a good draft gear, therefore, are:

I. A draw-bar of the strongest material to resist blows, jerks, etc., with secure attachments to transmit stresses received.

II. Adequate yielding resistance with minimum recoil, securely housed.

III. Fixed attachments to the car, strong and well-designed for ease of inspection of the gear, and well secured to the car so as to distribute and dispose of all stresses as advantageously as possible.

THE ESSENTIALS OF A GOOD DRAFT GEAR.

BY MR. ROY V. WRIGHT, M. E., P. & L. E. R. R.

The fact seems to be generally recognized, among railway mechanical men, that the ordinary spring draft gear is too light for the heavy service now required of it. The high capacity cars, and the large locomotives now generally used, and in the case of the steel cars, the stiff construction, have shown it to be defective in many respects. A careful study of the conditions and requirements to be filled lead us to believe that the following are some of the essentials of a good draft gear.

1st. A capacity of at least 100,000 pounds. That is it must have a yielding resistance amounting to this much, but it must be able to stand a blow of several times this amount without injuring it.

2d. A total draw-bar movement of at least two inches.

3d. A good draw-bar movement under ordinary pulls.

4th. A small amount of recoil compared to its capacity.

5th. It must be substantial. Repairs, except for unfair usage, should not be necessary. Parts should be of a simple and substantial design, and as few in number as possible.

First. The Standard M. C. B. Draft Spring has a capacity of 19,000 pounds. The twin spring and tandem spring arrangements would therefore have a capacity of 38,000 pounds. The tractive power of the large freight locomotives now generally used is greater than this.

The following is a quotation taken from the report before the Western Railway Club on tests made with the Westinghouse Dynamometer Car by the Lake Shore & Michigan Southern Railway Co.

"From the general results of the tests, it is believed that the tensile strains in draft gears with careful handling will frequently reach 50,000 lbs., with ordinary handling 80,000 lbs., and with decidedly rough handling, fully 100,000 lbs., while the buffing strains can be placed at 100,000, 150,000 and from 200,000 to 300,000 lbs., respectively, In extreme cases, the buffing strains will go considerably above the last named figure."

With these facts in view, it would seem necessary to have a better cushion than is accorded by the present standard rigging, and this opinion is strengthened when we examine the repair bills and note the damages which would probably not have occurred if a better draft rigging had been used.

Second. The present standard draft rigging allows a total draw-bar movement of 1¾ inches. This should be greater, in order that the mechanical energy may be more easily absorbed, and it would not seem wise to have it any less than two inches.

Third. There must be a good draw-bar movement under ordinary pulls, in order that heavy trains may be easily started. If the draft rigging is too stiff, it is quite evident that it will be harder to start the train, and where the locomotives are loaded to their limit, as is now the common practice on many roads, it would, in many cases; necessitate handling a lighter train.

Fourth. The recoil of a spring is very great compared to its capacity, therefore, if we had a spring rigging with a capacity of 100,000 pounds, the recoil would be so great as to be destructive. While it is therefore advisable to have a small recoil compared to the capacity, it would be well, when the rigging is under a load of say one-third or one-fourth its capacity, that the recoil be large compared to the force upon it, for this reason: When an engine starts out with a heavy train, it will often be noticed that after the engine has gone forward a few feet, it will come to a dead stop, and for a few seconds, appear to be stalled. When the recoil of the spring takes effect, it assists the engine and it will move forward.

Fifth. There seems to be a general opinion abroad that friction draft gears which, of course, come nearer filling the above conditions than spring gears, are not substantial enough, and will go to pieces or will give out after they have been in service awhile. Following the general principles of mechanical design, it would seem that a rigging designed with few parts, of a simple design and a durable material, and having large friction surfaces, ought to give satisfaction, provided such a rigging could be produced.

President: This brings us to the discussion of the papers before us to-day, on the "Essentials of a Good Draft Gear," by Mr. Herr, of the Westinghouse Company, and Mr. Wright, of the Pittsburgh & Lake Erie. Mr. Turner, will you make some remarks on this subject by way of opening the matter?

Mr. L. H. Turner: I have not given the advance copy as much attention as probably I should have done, but I am fully aware of the fact that this is one of the live subjects of the day, and something that is well worthy of our best attention.

Locomotives that develop from 45,000 to 48,000 pounds draw-bar pull are getting to be very common. Where this is the case, cars equipped with the heaviest M. C. B. standard draft from one to fifteen cars back from the engine must have their springs solidly drawn together. There are several devices on the market which are greatly in advance of the M. C. B. standard. None of them, I believe, has been largely adopted as yet. Undoubtedly the efforts made by the different patentees will bring out something very much better than we now have. And I know that Mr. Herr and Mr. Wright have given this subject a great deal of attention and undoubtedly will say something that will be of interest to us.

President: Gentlemen, the subject is now open for discussion. Mr. McIlwain, could you give us a little of your experience?

Mr. J. D. McIlwain: A great deal can be said on this subject. The rolling stock is growing heavier, loads are increasing in a greater ratio than the draft gear is being increased in strength. My idea is that the draft gear should be more directly a part of the frame of the car and that the drawbar connection to the car should be through a system of spring and friction buffers. As the buffing blow is greater than the pulling strain, it seems quite evident that resistance to the buffing blow should be greater in proportion than the resistance to the pulling strain.

President: Mr. McFeatters, we would like to hear from you.

Mr. F. R. McFeatters: I do not think I have anything on this question. We have not had any experience, you might say, between a friction draft gear and an ordinary draft gear, from the fact that the heavy loads we handle are all equipped with friction draft gear, and we handle none of any account of the ordinary cars, that is, wooden cars, equipped with the old-style draft.

President: Perhaps most of our members have not read the papers, and it might be well to take the question up and give us a kind of synopsis of the articles. I think everyone would then have a better understanding of it.

Mr. E. M. Herr: If there is no objection to giving some remarks from the paper which I have prepared, and which I was afraid some of you would accuse me of filling with glittering generalities, the draft gear question, as has already been said, is an exceedingly intricate one and one to which you can devote a great deal of your time and attention before any adequate solution is arrived at. It was not my purpose in giving the very few remarks that I have the honor of presenting to the Club to-day, to give in detail anything of the essentials of a draft gear, but rather to bring out the salient principles which should give a satisfactory design of draft gear.

The division of the subject into three parts occurred to me from the practical standpoint of having to deal with broken draw-bars in my past experience, and that naturally gave me the first division. In my present experience I am dealing more with the second division, with the yielding element, and perhaps rather naturally that would tend to present itself as of special importance. However that may be, it certainly does present to my mind the really important part of draft rigging, at least the part that is at the present time needing special consideration. We have for many years been dealing with the designing and construction of strong draw-bars. The question of the material it is to be made of has been gone into most fully. The design has been considered by a committee of the mechanical associations of the railroads, and many people have devoted a great deal of their time to the designing of such parts of the draft gear as I have put in the third division, namely, the fixed portion, and we have had for a long time different styles and makes of that portion of the rigging.

It has been, however, comparatively recently that the yielding portion has been given attention, and this is now receiving very considerable attention, and has for a year or more past received attention from a committee of the Master Car Builders' Association.

It was my privilege to have considerable to do with the dynamometer car mentioned in Mr. Wright's paper, and I want to say right here that it was a pretty difficult thing to get up a dynamometer car to record the stresses thrown upon draft rigging, particularly so as we did not know what the stresses were, and had no means of finding out. In fact, it was with the idea of getting some light on that subject that this car was designed. It was not designed to be a piece of apparatus mathematically exact. That is, you could not register with that mechanism the tractive force required to move one car on a level road, or anything of that sort. But it did serve its purpose to register and record the very heavy strains that were thrown upon the draft rigging in the ordinary service; not only in ordinary service, but to some extent in switching service. It was found before the experiments proceeded very far that even the great capacity of the recording apparatus of this car, about 350,000 pounds, was inadequate to record the stresses thrown upon the draft rigging in buffing, not in road service, but in switching service. In road service the strains do not amount to as much, but I believe are quite correctly given in Mr. Wright's paper. In fact, the whole matter of the amount of stresses and strains that are thrown upon draft rigging is treated better by Mr. Wright—in fact, entirely covered by him, and not by myself. I will, therefore, leave that matter for Mr. Wright's remarks, merely stating before I close what to my mind is a very essential feature of good draft rigging design, and that is, the absence of great recoil.

It would be comparatively easy to place great resistance in a draft rigging by means of springs if it were not for the fact that the recoil would be objectionable—in fact, would be inadmissible, for the reason that the spring recoils with practically the same power that it is pressed, and we all know that in buffing, the strains would frequently exceed the strength of the draw-bar in tension. It has been stated by many people that the matter of recoil is more of a bugaboo than anything else, and that it is not really a thing that needs to be given much consideration. Any one who went through or had the privilege of witnessing some of the tests that were made by the committee of the Master Car Builders' Association at West Burlington, known generally as the Burlington Brake Tests, would not make that assertion; as it was demonstrated there that the recoil was not only serious, but very soon became prohibitive when the draft spring capacity increased, and if we will follow the action of a train in passing through sags we will soon find that the recoil from the spring is very heavy, is quite important under those circumstances. It is also very evident when the emergency brake is used a very high tension in draft rigging in very long trains is developed, due to the difference in the retarding action of different portions of the train. This wave-like motion of the train often culminates at a certain point, and may have added to it at that time the tractive power of the engine and very serious strains in draft gear would develop. I have sometimes seen trains broke in three pieces, due to strains which I could attribute to no other cause than this recoil.

Mr. R. V. Wright at this point briefly reviewed his paper.

President: Are there any other remarks to be made on this subject? Mr. Gilbert, can we hear from you?

Mr. E. B. Gilbert: I do not believe I have anything to add to the subject.

Mr. F. R. McFeatters: I would like to ask what would be considered a good test for a draft, the length of time in service, before we could depend on a draft of any kind?

President: Possibly Mr. Herr or Mr. Wright could answer that question. Mr. Herr?

Mr. E. M. Herr: I do not know. I am afraid I am stumped on that. It is a little difficult to say just what would be the length of time that might be adequate. I used to figure in locomotives that if we could keep a thing running satisfactorily until we got the engine through the shop that it was doing pretty well. And to use that as some measure or a guide, whether you could apply any measure of that sort to a draft gear of a car is a little questionable, as you do not get them through with any degree of regularity. I think our friends in the active railway service would be better qualified to answer that question than I am. I might suggest on this question that perhaps a way to get at that would be to hear from people who have used different gears as to what they showed after certain periods of use. If I understand the question it is as to the durability of friction draft gears. Like any other device, it has wearing parts. Something could be judged of the time these devices might last by looking at the wear that occurs after a given period, even if it does not reduce the destruction of the gear.

President: Mr. Gilbert, have you any information to give on that subject? Have you used the Westinghouse draft gear to any great extent?

Mr. E. B. Gilbert: We have it under several thousand cars. We have not noticed any wear that would damage the gear as yet.

President: How long have you had it in service?

Mr. Gilbert: We had the first that was placed on cars, in the neighborhood of four to five years.

President: I think Mr. Gilbert has answered the question to a certain extent. He says they have had it in service four or five years and they have not noticed any particular wear on it. Mr. McFeatters can probably help us some along that line.

Mr. F. R. McFeatters: That is what made me ask the question, what would be the length of time when we would expect this draft gear to give out? If the present draft gear is inadequate, what could we get that would do better?

President: We have apparently come to the end of our lines, unless some of the others may have something to add.

Mr. J. D. McIlwain: If my memory serves me right, some years ago a committee of the M. C. B. Association made a report on the cost of maintaining cars. One item on that report that may be pertinent to the subject of draft gear is that the cost per year per car for repairs and renewals of draft gear was $7.00 and for other repairs $12.00.

A Member: I can remember about two years ago of examining a friction draft gear on the largest locomotives in this section at that time, which was operated by the Union Railroad, the road Mr. McFeatters is connected with, and he advised me that he could not get any other rigging that would stand the shock on those particular engines but the one he had applied. I do not remember what rigging that was, but I think it was the Westinghouse.

Mr. McFeatters: The first of our engines were equipped with the spring draft and ran pretty near a year. The center sills, of course, were "I" beams, and it was discovered that it was spreading those beams, and we had the Westinghouse people change the drafts on the tanks of the large engines, and that was in January or July of 1890, I believe; possibly 1891. I would not be certain, and we have not had any repairs on them since.

Mr. Herr: Before we close the discussion, I hope the members will excuse me for talking so much, but I would like to say one thing on a subject that occurs to me as perhaps of some importance. I touched upon it in the paper in the hope of bringing out some discussion on that point. It is as to the effect on draft gear of impact under different velocities, of tests with heavy loads moving at different velocities. We all know that the customary way of testing draft gears is with a drop test, which is dropping a weight, usually 1,640 pounds, from different heights. When that weight drops from a considerable height it attains quite a velocity before it reaches the object struck, and it has always been a question in my mind whether the results obtained in that kind of testing were as conclusive or intelligible as perhaps some other sort of test would be.

To illustrate just what I mean, you would all perhaps agree that if I apply the load—and this is just a different method of applying the load—on the object tested with a lapse of time in its application; in other words, if it is brought about with a very steady, gradual pressure, we would have results very different from what is produced when it is dropped, that is, by impact of the same load moving at considerable velocity. The blows that draft rigging receive in service are brought about by large bodies of great weight moved with comparatively slow velocities. And the question I raise is whether we are discovering just what we need in a draft rigging when we strike it with a comparatively light body moving at a considerably greater velocity. Of course, if you were going to produce something that would resist the impact of a projectile you would want a body with great mass. A great deal of your inertia or energy would be used up then in disturbing the mass. But that sort of thing would not do for a draft gear, for the load there is applied with ample time for even a large mass to be moved, and then the destructive effect remains upon the object struck. In other words, the thing we must be careful about in testing draft rigging is to be sure that the tests are such that they will really give us the information that we are seeking, and to my mind the drop test does not quite answer that requirement. It is a great deal better than loading the thing up with a dead load; there is no question about that; but the real test, the proper test, is somewhere between the application of a steady load and the application of the blow received from a body of comparatively light weight moving with very considerable velocity.

President: Gentlemen, if there are no other remarks to be made on this subject, as we have finished up our business, a motion to adjourn would be in order.

On motion, adjourned.

EDWARD KERR, President. W. R. BROWN, Supt. G. W. GOSSER, Sec'y and Treas.

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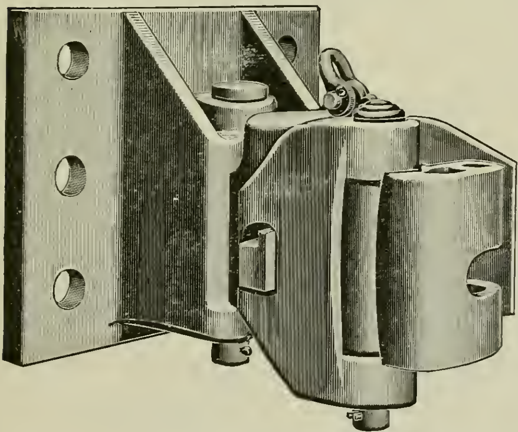

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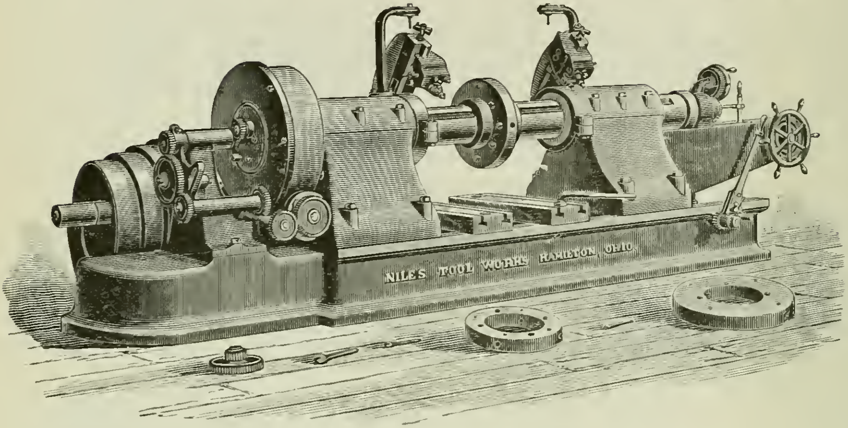
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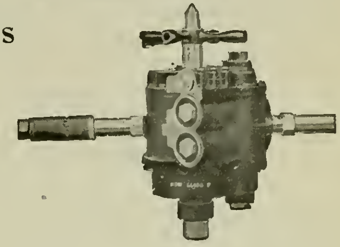

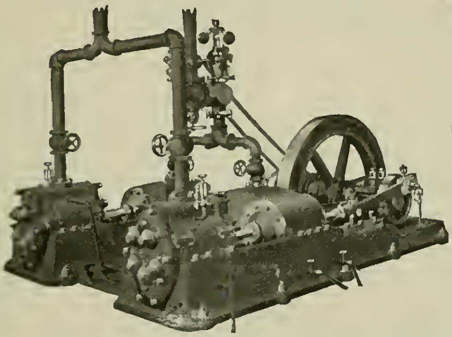

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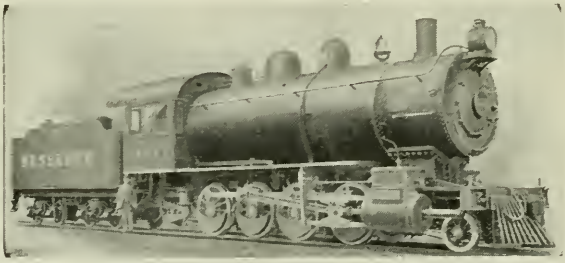

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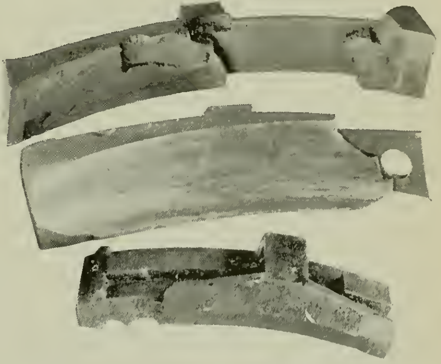

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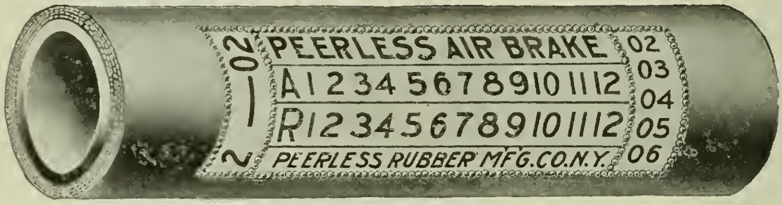
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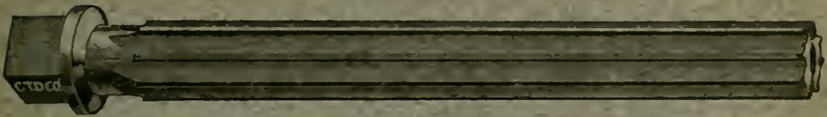

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ORGANIZED OCTOBER 18, 1901.

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Manager American Locomotive Co., Pittsburgh, Pa.

Vice-President,
L. H. TURNER,
Supt. Motive Power, P. & L. E. R. R.
Pittsburgh, Pa.

Treasurer,
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Sales Agent, J. D. McIlwain & Co.,
Pittsburgh, Pa.

Secretary,
J. D. Conway,
Chief Clerk, Supt. M. P., General Offices P. & L. E. R. R., Pittsburgh, Pa.

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Syracuse, N. Y.

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Pittsburgh, Pa., January 23, 1903.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
JANUARY 23, 1903.

The meeting was called to order at Hotel Henry, Pittsburgh, Pa., at 8 o'clock P. M., by Vice President L. H. Turner, in the absence of President J. H. McConnell.

The following gentlemen registered:

MEMBERS.

Anderson, Thos.
Bell, W. K.
Bole, Robt. A.
Brown, John T.
Campbell, G. M.
Carson, G. E.
Connolly, W. E.
Conway, J. D.
Crouch, A. W.
Currie, J. C.
Diamond, P. R.
Evans, S. D.
Forsberg, R. P.
Francis, John S.
Gies, Geo. E.
Gilbert, E. B.
Grooms, J. C.
Hastings, C. L.
Hooff, J. L.
Howe, D. M.
Hunter, H. S.
Hyndman, F. T.
Johnson, Wm. T.
Kessler, D. D.
Macoubray, R. J.
Malloy, M. A.
Mercer, R. S.
Milligan, John D.
McCormick, W. H.
McCracken, John.
McIlwain, J. D.
McNulty, F. M.
Pelletier, Louis.
Redding, D. J.
Richardson, W. P.
Shaler, Fred J.
Sherman, C. W.
Simons, J. E.
Stucki, A.
Tesseyman, J. E.
Tucker, John L.
Turner, L. H.
Walter, E. P.
Wood, C. V.
Wright, R. V.

VISITORS.

Kerr, W. S.
Mann, H. F.
Phillips, Edward A.
Scott, Dr. X. C.
Sewall, J. H.
Smith, Sion B.

President: The first order of business is the reading of the minutes, but inasmuch as the proceedings of the last meeting have been published, if there are no corrections to be made, we will omit that.

Secretary: The following applications for membership have been received:

I. N. Kalbaugh, S. M. P., W. Va. Central & Pittsburgh Railway, Elkins, W. Va.

W. A. Marsh, Sales Agent, Pittsburgh Coal Co., Fifth avenue, Pittsburgh.

H. G. Parker, Shipper, Pittsburgh Coal Co., Fifth avenue, Pittsburgh.

H. P. McCue, Superintendent Transportation, Pittsburgh Coal Co., Fifth avenue, Pittsburgh.

S. B. Keys, Agent, Consolidated Car Heating Co., Park Row Building, New York, N. Y.

P. L. Lobez, Draughtsman, Westinghouse Air Brake Co., 820 South avenue, Wilkinsburg, Pa.

W. L. De Remer, Representative Spencer Otis Co., Plymouth Building, Chicago, Ill.

Gerald E. Merchant, 219 Cutler Building, Rochester, N. Y.

Arthur Pancoast, General Manager and Treasurer, Union Spring & Manufacturing Co., New Kensington, Pa.

Bailey E. Hobson, President, Tri-State Mining & Manufacturing Co., No. 248 Fourth avenue, Pittsburgh.

John McCracken, Representative Wisconsin Graphite Co., P. O. Box 988, Pittsburgh, Pa.

J. E. Tesseyman, Head of Order Department, Pressed Steel Car Co., Allegheny, Pa.

H. G. Scheck, Road Foreman, Engines, Monongahela Division P. R. R. Co., Thirty-second street, S. S., Pittsburgh, Pa.

Several communications were read by the Secretary and upon motion ordered filed.

The Secretary read a suggestion made by one of the members, as follows:

It has been suggested that, in order to compile all information possible upon any given subject, the matter be taken up with all Railroad Clubs in the country to perfect arrangements whereby all Clubs will discuss the same subjects in the same month, and that arrangements be made whereby each Club shall appoint one member on a subject committee, the committee to meet at some given point and arrange the subjects for the entire year, it being believed that where members provide themselves with the proceedings of all the Clubs, that each subject by being treated by all Clubs, will be thoroughly exhausted, and about all the information pertaining to it will have been brought out.

It is recommended that action be taken to-night directing our Secretary to write the Secretaries of all Clubs, asking them to bring it before the Clubs they represent and a report to be made as soon as action has been taken.

President: Gentlemen, here is a subject that is worthy of careful consideration and of encouragement. The hardest work a Railway Club has is to get good subjects and good discussions, and these are the life of the Club. I believe if we could get all the Clubs to discuss the same subject the same month, we would get 25 or 30 odd opinions on the same subject. And by filing the proceedings of each Club, you could at any time refer to them and get the subject you want in all its details I would like to hear a full discussion among the members of this subject.

Mr. F. H. Stark: Mr. President, I think the subject a good one for several reasons. Not that I have had any time to think about the matter, but these thoughts strike me. Frequently a subject is taken up at the Chicago Club and the members of the Club participate in the discussion and come to a general conclusion that this or that particular device is the best, while the local conditions have a great deal to do with it. For instance the question of car roofs. And a car roof that is a success in the northwest is not a success in the southwest. And so it might be with other subjects, local conditions govern; and if we in the east should be governed by the sentiments expressed on the Pacific Coast, we might be led astray. If each Club should take up the same subject at the same time we could get at it in a more intelligent manner.

In order to get it before the Club, I move that the Secretary be instructed to correspond with the Secretaries of the various other Clubs and ascertain what can be done about it.

President: You have heard the motion. Are there any other remarks?

Mr. J. E. Simons: The thought occurs to me in connection with this matter that we might go a little bit farther, as far as the publication of the journals is concerned. Of course, there might be side issues that would concern the individual Club directly; but when it comes to a general matter which would be of interest to the members all over the country, I believe it would be the wise plan to put the whole thing into one journal. Let us have a good publication. That is, have the thing resolved down to such a basis that the matter would be intelligible to members of all Clubs. Now, I do not know how you would feel, but it appears to me that if I was taking all the journals from Clubs all over the country, I would not feel that I had time to sit down and pick out for myself from the discussion of the various members, the meat of the subject. I believe that if we are going into it in a genral way we should have that subject boiled down in such form that we could get at it without having to digest the contents of all the journals and get at just what we would like. I believe that is a step further that we ought to take at the same time. If the papers and discussions can be covered in one club I see no reason why a good intelligent journal could not be run, that would cover the whole subject for all Clubs for that month.

Mr. J. D. McIlwain: I rather favor the motion. As has been stated, we have some trouble in getting papers that will be interesting. If a general committee was formed, composed of one member from each Club, or locality, no doubt they could present subjects enough to keep us busy and that would be of general interest. This might be considered as infringing upon the prerogative of the Master Car Builders' Association. As to making a general journal for the whole brotherhood of Railway Clubs, I hardly think that would be practicable.

If a scheme like that proposed, should be consummated, it might be well for the Committee to select subjects three or four months ahead and after the discussions are made, the Committee to dissect and analyze them and issue a joint report which could be published in each Club journal. This joint business not to interfere with each Club's local business or discussion.

We have a gentleman with us from New York, Mr. Phillips, who has had a wide experience in railway and club journalism. I am sure he could give us an interesting talk on club work.

President: We would be very glad to hear from Mr. Phillips.

Mr. E. A. Phillips: I am rather surprised to be called on at such short notice, to contribute to this subject, and I cannot say that I am in position to offer any special advice in the matter except to say that I think that the idea as a general one is good, and it is also I think perfectly feasible, though I question if accomplishing it would not encounter a great many difficulties on account of the individuality of certain clubs, and more particularly the sectionalism which disrupts some of the clubs. I do not know whether sufficient accord could be found among them to bring such a desirable thing to perfection.

From the point of view of the publisher alone, the thing is perfectly feasible and could be done. And I think it would conduce very materially to the improvement of the literature of the clubs. Whether it could be done satisfactorily in view of the fact that some of the clubs at the present moment derive considerable revenue from the advertising in their club journals which they would be loth to part with, is another soft part to death from friction, while enroute to place of destination.
matter and one in which we would be likely to meet objection. I think that is all that I can contribute in a tangible way at present.

The motion being put to vote, was duly carried.

President: The paper for the evening is on the subject of "First Aid for the Injured" by Dr. J. D. Milligan, chief surgeon for the P. & L. E. R. R. Many of us have not read the advance copy, and I will ask Dr. Milligan to read his paper for us.

Dr. J. D. Milligan: Mr. Chairman and Gentlemen: Without making any preliminary excuses, I refer to my friend Mr. Conway for getting me into this predicament, and it is my privilege at the present time to prescribe and inflict on you this coming prescription:

FIRST AID TO THE INJURED.

BY DR. J. D. MILLIGAN, CHIEF SURGEON P. & L. E. R. R.

From the time of Creation, more than 5963 years ago, our subject was introduced, but probably not practiced with that masterly detail that is now found to be a Standard almost universal, but nevertheless the necessity of first aid was recognized and clearly defined long before Railroads or Armor Plate Mills were even dreamed of; but not before Surgery as an Art had been established. The time and instance referred to was in the Beginning for it is recorded in Holy Writ, and no one can dispute this historial fact; that it was not good for man to be alone, and a deep sleep fell upon Adam (He was anesthetized) and a rib was removed (first surgical operation) and woman was created a helpmeet, or the First Aid toward raising a family and other things was then and there inaugurated—and the next instance refered to, was when Adam and Eve found it necessary to have some aid and protection from certain frost conditions which was closely associated with the Apple Crop—and as they were hustling around the first dressing they got was the fig leaf adornment, which has been emblematically handed down to the present day.

But, pressing rapidly along from century to century, we see that the next time we have any specific data is in the year 1023, when permission was obtained to establish a Hospices in Jerusalem, which was done by the order of St. John the Baptist, and it was dedicated in the year 1048, and the Confraternity was called "Hospitaliers of St. John of Jerusalem." The badge of the order was the well-known Maltese Cross; and step by step this benevolent order added organization after organization, till the Red Cross order in England was instituted and initiated, and in 1872 established an ambulance service in the mining and pottery districts, where accidents were of frequent occurrence.

That with all the modern Equipments and Schooling of Employees; either because of inefficiency or carelessness on their part, or that of their fellow employees: there is still a large number of injured, the largest per cent being employees—then trespassers, and last, fortunately, come the passengers, with many damage suits. But, with this knowledge, it is a humane act to provide for just such contingencies, and how this can be most successfully done is the purpose of this paper and the province of this association to assist.

First Aid has been thoroughly discussed at home and abroad and many valuable suggestions have been brought out by the rank and file, from track walker to General Superintendents, aided by the Surgeon, each knowingly or unknowingly contributing something toward perfecting the system, until, at the present time, there is a standard of uniformity that is bringing pleasing and profitable results; but so long as the wheels of industry and the various potential Creators of Commodities continue, so long we will have injured men.

When we consider that on June 30, 1901, the total number of Railway employees in the United States numbered 1,071 169, of which there were not classified 3,107 and 38 816 were required for general administration, making the classified service consist of 1,029.246 men, of which 41,142 injured and 2,675 killed—and of passengers the total number killed 282 and of injured 4,988 and the total of trespassers killed 5,498 and injured 7,209, and we find that for the months of July, August, and September, 1902, the casualties of passengers and employees while on duty amount to 12,007 (845 killed and 11,162 injured). Number of passengers killed 79 and injured from all causes 1,969—the total of employees 766 killed and 9,193 injured. This shows an increase over the statistics of 1901, but the increased number of employees and increase of passengers carried and our inability to secure the statistics of the same—lead us to believe that there is a less ratio existing at the present date. We desire to call attention to the fact that in that statement we mean all who die within 24 hours—are declared killed—and all who are disabled to the extent of three days or more, are classed as injured, it shows at a glance that there is plenty of room to apply first aid, and also the grim necessity of prompt and efficient application of the same.

Therefore, the adoption of what is known as "First Aid" as applied to Railroad service is in conformity to the Standard Systems used by the St. John's Ambulance Association of England and adopted by Germany and nearly every European State, as well as by the New York Society for Instruction in First Aid—a system of education for Employees that will enable them to aid the injured intelligently, and which system has reached a standard by many Railroads, that compares favorably with the first aid in the Military service.

A little knowledge is dangerous, and we find sometimes that the prayer of the injured is not always: Oh: Lord: protect me from mine enemies, but it is: Oh: Lord: save me from my friends—for it does happen that some over-zealous person may in a moment undo what nature is trying to do—and would have succeeded if the case was left alone.

"The first dressing decides the fate of the wounded" was a maxim laid down by Volkman, and it is true that it will never lose its significance—and it is true that much of the argument must be lost when the position is taken that we must make Amateur Surgeons of our Engineers, Firemen and Conductors; and such other members of the Crew as may be designated "Emergency or First Aid Men;" but it has never been shown that such was the purpose: to expect of the laity anything else than to add comfort and safety to the sufferer. And, while it is equally true that these men are not Surgeons in any sense, yet they can be properly enlightened so that they can do the right thing, or the simple, necessary thing in the emergency, to relieve suffering, or stop a bleeding wound until the arrival of the Surgeon; thereby rendering comfort and safety, which means everything to the sufferer.

As applied to the Pittsburgh & Lake Erie, the institution of the first aid, has been in force for about two years, and as yet in its infancy, so far as thorough teaching is concerned, but with that potent fact staring us in the face, we are prepared to say that we find when injury occurs, that the unfortunate victim reaches the Surgeon with greater safety to himself, and instead of finding him bloodless, we find the Rubber Tourniquet properly applied, an antiseptic pad over the wound, and a bandage over it to hold it in place; and should it be a broken limb, a temporary splint applied to keep the broken bones from doing additional injury, by goading the soft part to death from friction, while enroute to place of destination.

The marked improvement in the general condition of the injured on their arrival at the Hospital has been such that it is now the exception to find a man so exsanquinated that he cannot at once be placed on the operating table; while previously, the reverse condition was the rule; to find his life ebbing slowly away, because no one seemed aware that hemorrhage could be safely controlled by properly applied Tourniquet, and we feel safe in saying that by the judicious first aid the death rate is much lower and the injured ones made more comfortable, and with these results obtained, we should be encouraged to a more vigorous and thorough effort to secure the most efficient detail and co-operation that can be afforded by the Management of the various Railroad Companies.

Our First Aid or Emergency Box contains Bandages, assorted sizes; Sublemated guaze, Rubber Tourniquet, Cotton, Safety Pins and enough to care for two or three injured persons. Our Folding Stretcher contains two blankets and one rubber blanket, and four splints, assorted. Each Caboose and each baggage car has a set of these supplies—each station and telegraph office is similarly supplied. A small handbook has been issued to the men, and a circular has been placed in the hands of the men, entitled "Aid to Memory." The first aid to the injured and the same is herewith attached:

AID TO MEMORY.

FIRST AID PACKAGE.—For small wounds on any part of the body.

GAUZE.—For large wounds.

COTTON.—To cover over on top of the gauze.

RUBBER BAND (Tourniquet).—To fasten around a limb or around the head to stop hemorrhage, particularly in case of crushed limb.

ADHESIVE PLASTER.—To hold dressings, but never to be applied to an open wound.

COTTON BANDAGES.—To be used over first dressings where there is much bleeding.

GAUZE BANDAGES.—To fasten splints in place and to support light dressings where there is no hemorrhage.

SAFETY PINS.—To fasten bandages, etc.

First—Don't give a drink of whiskey.

Second.—Don't pour ice or very cold water on wounds.

Third.—The patient should be placed on his back, with head low, and this position should be continued in transporting.

Fourth—IF THE PERSON IS SUFFERING FROM "SHOCK," that is, pale with pinched expression of face, drooping eyelids and cold surface of body, with feeble pulse, give spoonfuls of hot tea or coffee; if this cannot be had, teaspoonful of whiskey or some other alcoholic stimulant, in a tablespoonful of hot water every ten minutes until five or six doses have been taken. Wrap in a warm blanket and put hot water bottles or heated bricks about the body.

Fifth—REMOVE THE CLOTHING from the wounded part by cutting it away. Do not attempt to tear or draw clothing off, as this may further injure the wounded part. Always see the wound and know by your eye just what the nature of it is.

Sixth—IF A LIMB IS CRUSHED OR TORN apply over the wound a thick pad Gauze, then a large covering or pad of cotton, fastened with several turns of the bandages, handkerchief or an elastic suspender.

Seventh—HEMORRHAGE.—This follows shock and is very rarely severe unless reaction takes place. TOO MUCH STIMULATION INCREASES HEMORRHAGE and for this reason it is best to give only a little stimulant, well warmed, and repeat the dose if reaction is delayed.

BLEEDING IS OF TWO KINDS.—First—Arterial—When the blood comes out bright and red in spurts. Second—Venous, when the blood is dark and flows in an even stream.

A.—TO STOP HEMORRHAGE.—Avoid trying to stop bleeding by twisting cords or handkerchiefs around limbs with sticks. When the wound is large and blood comes out in spurts, apply the rubber band tightly just above the wound, previously raising the wounded member or part, especially if it be a limb. Be careful to put the band on uninjured flesh (if the limb be crushed) and about 3 inches above the crushed tissues, else it will slip down, and increase the hemorrhage. Be careful to see that the band be firmly hooked and fixed before leaving it. Small wounds, even though the hemorrhage be arterial, require only a firm compress of the sublimated gauze, placed immediately over the wound and bandaged tightly in place with one of the muslin bandages. It is best after this to bandage firmly from the extremity of the hand or foot upward to beyond the wound with muslin bandages.

B.—VENOUS BLEEDING, which occurs when the wound is shallow (does not go deeper than the skin), as a rule, requires firm pressure over the wound and especially below it. If the wound be quite small, put a pad of styptic cotton into it and over it and bandage tightly in place and then apply a bandage from below upward.

C.—BLEEDING FROM THE HEAD.—If only the scalp is involved, may also be controlled by drawing a rubber band around the head, encircling it just above the eyebrows. This is very painful, however, and unless the bleeding is severe, it may be controlled by bringing the wounded or torn surface together and applying along the wound a thick layer of styptic cotton and over this another layer of absorbent cotten and a tight muslin bandage. It is well to pass the bandage under the chin if the wound be on top of the head, as this holds it firmer and tighter.

Eighth—AFTER HEMORRHAGE HAS BEEN CONTROLLED apply gauze next to the open wound always and never let an open wound remain uncovered longer than absolutely necessary to control the hemorrhage, but remember a soiled or dirty covering is worse than none at all.

Ninth—IF A LEG OR ARM IS BROKEN, straighten it gently and lay on a pillow, then tie the pillow up with several strips of muslin, bandage, or splints found in the stretcher, laths or barrel staves, padded with some soft material, may be used for this purpose. This should be done before the injured person is moved any distance.

Tenth—COMPOUND FRACTURES are fractures accompanied by a wound of the soft tissues at the point of fracture, so that the bone is exposed to the air. In these cases treat hemorrhage and the wound according to the foregoing rules, and then apply splints. If the bones project beyond the skin, remember to bring them back into place by pulling the extremity in the direction of the displacement, until the ends of the fragments are quite free from over-riding. Remember to always cover these wounds with the sublimate gauze and bandage.

Eleventh—BURNS.—Carefully remove the clothing by cutting it off, if the part be clothed and apply immediately three or four (3 or 4) thicknesses of the sublimate gauze (dry or wet, in warm water in which one tablespoonful of the bicarbonate of soda to the quart has been dissolved). As a rule never attempt to clean burns immediately after they occur. Cover the wounded part immediately, as directed above, and leave the cleansing to the surgeon afterward. Extensive burns are attended with great shock, as a rule, and require FREE STIMULATION. As the burns are rarely followed by hemorrhage, stimulants may be and should be given in considerable quantities.

Twelfth—PROSTRATION FROM EXCESSIVE HEAT —In these cases (not sunstroke) the face is pale, lips colorless or blue, breathing slow, pulse slow and very weak. Place the patient on his back, with his head level with his body and loosen clothing. Apply heat to the surface of the body and extremities. Bathe the face with warm water into which a little whiskey or alcohol has been poured, and if he can swallow, give the patient an ounce of whiskey in as much water.

B—PROSTRATION FROM DRINKING TOO MUCH ICE WATER WHEN OVERHEATED.—The face is red or even purple, breathing heavy and irregular, pulse irregular. Loosen clothing, place on back, with head slightly elevated. Give hot drinks, apply heat to the spine and the extremities.

Thirteenth—POSITION IN WHICH A PERSON SHOULD BE PLACED AFTER INJURY.—Injuries to the head require that the head be raised higher than the level of the body. In all cases, if practicable, lay the patient on his back, with the limbs stretched out in their natural positions;

loosen the collar and waist bands and unless the head be injured, remember to have the head on the same level as the body; do not bolster it up with anything.

Fourteenth—TO PLACE A PERSON ON A STRETCHER TO CARRY HIM.—Three persons are necessary to do this; two to act as bearers of the stretcher and one to attend to the injured part. Place the stretcher at the head of the patient. on a line with the body, the foot of the stretcher being nearest the patient's head. One bearer kneels on each side of the patient and join hands underneath his hips and shoulders with the bearer on the opposite side. The third man attends to the wounded limb or looks after any bandages or splints that may have been applied. The bearers then rise to their feet raising their patient in a horizontal position and by a series of side steps bring the patient over the stretcher. He is then lowered gently on it and made as comfortable as possible. One bearer starts off with his left foot and the other with his right; should they keep step the stretcher would roll badly.

President: In view of the fact that neither mechanical men nor supply men are in position to discuss this subject, we will turn it over to the profession. We have with us Dr. X. C. Scott, of Cleveland, consulting surgeon of the New York, Chicago & St. Louis Railroad, from whom we would be very glad to hear.

Dr. X. C. Scott: I have often wondered why a doctor is called upon to make a speech, because when I was in college all the men who could talk well were made either railroad men, preachers, lawyers and lastly came the doctors who were never expected to make a speech.

I have been greatly interested in this paper. It is excellent. But it seems to me that the most practical question for railroad men to consider is what are the cardinal points to be taken up by them in this very important part of their work. It strikes me the questions of shock, hemorrhage, broken limbs and pain are the very important things. There are other things, but these are the essential ones. Railroads should employ their surgeons to instruct their employees how to meet and handle these conditions. I have had a large experience in teaching, both with medical students and with nurses in hospitals, and I have not found one that could apply a simple bandage as it should be done unless I had personally demonstrated to him or her, several times, how to do it. All your employees, who are expected to act as first aid men, should be instructed and well drilled by your surgeons. The surgeon should make a thorough demonstration of what he is trying to teach them and then the men should be compelled, individually, to do the same thing and be quizzed as to what the instructor meant by this and that, to see how well they understand the subject of instruction. Judging from my experience with medical students who are studying medicine and surgery, and nurses who are every day in the sick wards of hospitals, I will warrant you that the first time you quiz them, you will be astonished to find how little they know, or perhaps that they don't know anything. You may read all the first aid manuals that ever were printed and have first aid training all that can be taught, and you may have every first aid system that can be devised, and yet they will not make a relief fit to take the place of a surgeon. You do not and cannot expect that. But you can do this with your men, if you demonstrate to them, time and time again, what you desire them to know and see that they can intelligently carry out what you have taught them, you will find that they can do much good, by placing an injured person in a proper condition and that by placing an injured or fractured limb in a proper position they may be the means of saving a limb or even a life. All these things you can do.

In regard to shock, I think that perhaps the first thing that should be taught to every trainman, is that they should never raise a person upright who is suffering from shock, but that the head and body should be kept low and in a reclining position. It is a wonderful thing that in shock, where the nervous centers and system are so prostrated, that you find the veins of the head and upper extremities so much engorged that some surgeons have advised opening these, in severe cases, to allow an escape of blood. Of course you cannot expect a first aid man to do this. I have no question in my own mind that in severe cases of shock, life can be wiped out in a second by raising or changing the injured from the proper position.

The next thing is hemorrhage. You cannot say more than has been said in the paper in reference to hemorrhage, unless it be to emphasize the importance of thoroughly instructing the first aid men as to the region of all the large arteries, and where compresses should be placed to control the hemorrhage, if necessary.

In compound fractures, I think that under no conditions should a layman be allowed to attempt to draw such broken bones back into place, because in many cases they will cause great laceration of parts or may tear a hole in a large blood vessel and thus increase the danger of the injury.

Your first aid man should be taught to place the injured parts in position—apply temporary splints and take the injured person to the hospital or home, where the doctor or surgeon will reduce the exposed ends of the broken bone, as it should be done. Every doctor knows, that in many cases of compound fracture, we have to enlarge the wound in order to get the bones back in place. By making the wound a little larger with a knife will do no harm, and it is a very different question from lacerating the parts by forcing the broken bones back into place through the original opening caused by the injury. A simple incised wound heals almost universally by first intention, while in a contused and lacerated wound we naturally expect more or less supuration.

The handling and transportation of the injured is a very important question and should be most thoroughly impressed on the minds of your first aid relief. They should be well drilled in how to lift and place the injured on a litter, so as to do as little harm as possible. Of course in many cases three men are sufficient to carry a person and place them on a litter, but many cases require more. I believe that, with a person having a compound comminuted fracture, three men cannot properly handle such a case, but that it would require five persons to do it as it should be done—one should steady the head —two carry the body, and one to carry each leg. Of course there are exceptions in these cases.

In one respect I would go further than any instructions I have seen in any first aid manuals, and that is, I would instruct the trainmen how to use the hypodermic syringe to control pain, and I would also instruct them how to use strychnia hypodermically. Morphia and Strychnia are now put up in tablets in such small quantities, that your first aid men can use them to relieve pain and stimulate the nerve action if they are properly instructed. Why should injured persons be allowed to suffer pain when it can be lessened or totally relieved? It is certainly a very important thing to be able to quiet pain and stimulate the heart action. Other surgeons may differ from me on this point, but, notwithstanding, I would urge that first aid men be so instructed, to be able to prevent suffering and save life.

Lately in Cleveland we have had a demonstration that is very extraordinary to me, in the experiments made by Drs. Lower and Crile. They have been making experiments in the use of Adrenoline in reviving animals suffering from shock and apparently dead. They have taken a dog, chloroformed it and then choked it until, apparently, dead. After 15 minutes they have injected Adrenoline into its veins and that dog has revived. They have had no opportunity to use it in shock with human beings, but with dogs they have repeated it several times, simply showing that in shock the vaso-motor system is still active. Inquiring of Dr. Lower about these Adrenoline experiments and the use of it, he told me that they injected about two ounces of the standard saline solution, which contained about one part of Adrenoline to 50,000 parts of the saline solution. He said that their first experience showed that the effects of the injection soon passed off, and that it was followed with greater collapse, but that they soon discovered that by keeping up the injections of Adrenoline-saline solution of about five drops per minute, the favorable condition was maintained and the collapse prevented. In cases where there was complete decapitation of the dog's head, evidence of live was kept up by these injections. Of course the use of this remedy requires a skilled surgeon, and a layman could not do it. Now if such wonderful results can be obtained with the dog, have we not the right to reason and believe that if a doctor could apply this solution to the injured within a few minutes after the accident, even if the person is apparently dead, he might bring about a recovery. Now, if this should prove true in future experiments, it would show this to be one of the greatest discoveries in modern surgery.

Adrenoline is an extract taken from the capsules above the kidneys, and besides its effects on the vaso-motory system, it has a wonderful effect as a local application to mucous surfaces. In my hands it has been the best remedy for the abatement of Hay Fever that I have ever tried.

These experiments of Drs. Lower and Crile are very extraordinary, but as yet they have had no opportunity to try the remedy on man in a case of severe shock—they propose to do so the first opportunity that presents itself.

If a man, who has been apparently dead for some ten minutes, can be resuscitated and kept alive until the heart's action is restored and respiration is re-established, it means a wonderful advancement and progress in modern surgery.

Gentlemen, I did not expect to say anything here to-night. I thank you. (Applause.)

President: I think I ought to retract a portion of what I said in regard to the discussion. We have a gentleman with us who represents the claim department, who takes charge of the patient after the doctors are through—provided the man lives: and I will call upon Mr. J. C. Grooms.

Mr. Grooms: Mr. President and Gentlemen:

I must ask your pardon in advance for what President Turner causes me to inflict upon you. Part of my duties are to care for our injured employes and others on the Pittsburgh & Lake Erie Railroad, after the doctors are through with them, and I hope you may not consider it a digression if I add that our surgeons are faithful in the discharge of their responsibility, and that they assume a personal charge of the individual cases, earning the gratitude of the injured, and making it easier for the Claim Agent.

I see before me faces of practical business men, whom I think want to know the economic as well as the humane side of the case before us. It is the practicable application of the subject that appeals to me, and this must be shown to our railroad friends and others employing large numbers of men, to attract their attention and induce them to use it.

In this instance about "first aids" I think the old saying that "a stitch in time saves nine" is aptly applied. Our experience is that we have accomplished a saving beyond our expectation, coming out of the "first aids."

You may not all be railroad people, but you are all familiar with instances leading to injuries of men about railroads and in machinery, both in your shops and other places where men are employed. The first thing is to help the man and help him systematically and practically. We aim to do this by having on each train, at each station, at the shops and other places where they may be needed, packages of "first aids" for use of our injured, and all employes know this, and are becoming familiar with the practical use and application of them. With us we consider any injury, from a slight scratch to those more serious, resulting in death, and a report is kept of the disposition of each case.

The benefits derived from the use of "first aids" to our people have been gratifying, and from an actual financial consideration, has more than paid its cost, and given most satisfactory results in aiding the injured, whether the patient is taken to the hospital for a serious operation or a slight injury, only requiring attention at the doctor's office.

Our people have no insurance association connected with the road for the protection of its men. However, an engineer, conductor, brakeman, track walker or other employee injured, receives consideration, and, in nearly every instance, financial aid, when he receives a serious injury necessitating his being laid off duty. We have never set a limit, owing to the fact that there are no two men who can be considered from the same standpoint; but we seldom ever make an allowance for less than ten days, however, that would depend upon circumstances, as some men cannot lay off duty a week without suffering loss. We do the best we can to consider each case individually. We first take into account how long he has been in the service. He may have only been with us a month before being injured, or he may have had a long term of service with us, and only slightly hurt. Then we consider whether he is married or single, and the size of his family; he may have a wife only, or he may have several children; he may be paying for property purchased, or renting his house, and, if single, may be a long distance from home and boarding, or staying with his parents. You may think it impossible, but we try to apply this to each case. If our employes were compelled to carry insurance policies, the story might be told in another way.

Then these "first aids" have been useful in many instances to passengers injured on our trains, and the results have been as gratifying and of as much practicable benefit, as with our employes.

I was on a train of one of our eastern railroads last summer, and the crew received a message to look out for a passenger supposed to have fallen from a west-bound train at a certain point. The engineer found the man lying near the track with a large gash in his head, caused by falling on the end of a tie, besides cuts and bruises over the body. The man was picked up and put into the baggage car, and I went forward to see him. There was not a thing on that train that could be used by the surgeon who came forward to bind up the wounds or stop the flow of blood, and several of us contributed from our personal effects in response to a call from the surgeon, who had volunteered his services, and he was given the best care possible under the circumstances. He was taken to the hospital and died two days afterwards. This man's life might have been saved if there had been "first aids" in the baggage car on that train, and the flow of blood could have been stopped and other injuries attended to.

With us we have from six hundred to nine hundred people hurt each year. Of these some remain in the hospital from three to six months, some a few days, and some will not go to the hospital at all.

In order to make a practicable application of the advantages and benefits derived from "first aids" to our railroad, our surgeons and myself have estimated that one hundred men out of the great number injured within the year would remain in the hospital at the expense of the company for at least three months, at about one dollar per day, which would amount to about ninety dollars each. We would probably make each man an allowance of ninety dollars more. There is one hundred and eighty dollars for one man, or eighteen thousand dollars, total cost.

To-day it is estimated that with the care given the men, they would not remain in the hospital over sixty days. The allowance would be thirty dollars less, and the hospital expense would be thirty dollars less, making a total of twelve hundred dollars for the same number of persons injured. This difference of six thousand dollars is more than the expense of "first aids," including blankets and stretchers. Besides this the men have received better care, and are in better condition to be treated by the surgeons. Our surgeons are of the opinion that at least ten lives have been saved within the last two years. Is anything else necessary that "first aids," as applied in these cases, have been a blessing to these men and economy to the Railroad Company? I think they should be in the shops, mines and at all places where large numbers of men are engaged in dangerous employments.

Our Company is now considering a method of having our surgeons give the employes special instructions in the method of applying "first aids," and when this is done, we see nothing that can be added to an almost perfect system of caring for its injured. (Applause.)

President: Would any of the gentlemen like to offer any remark or ask the Doctor any question? If not, Dr. Milligan will close the discussion.

Dr. J. D. Milligan: Mr. President and Gentlemen—It did not take long for the prescription to act. If it was such a knockout as that, you must have taken the medicine.

I recollect a story that was told on me some years ago, before I recited to Professor Scott in 1874. He does not know me, and I will be quiet until I get through with him. Along in my early period of practice it was stated by some one that a lady was very seriously ill, and that her little son was out on the door step crying. And this gentleman, kind-hearted, like Brother Grooms, stepped up to the boy and said, "What is the matter, my boy?" The boy replied, "Mother is going to die." He said, "It can't be possible. Who said so?" "Well," he said, "it is possible, because Dr. Milligan says so, and he knows what he gave her." (Laughter.)

So I had hoped, at least, that this paper would bring out many suggestions which might be added in support of the paper, or severe criticism which I hoped I had provoked.

I might answer a few little points, and first, as Professor Scott taught me in 1874, at the old Western Reserve School, he used to try to make men believe all he said and did—and believe all he says to-night. But I did not agree with Dr. Scott in everything that he said then or says now. I am candid and honest when I say that a little knowledge is dangerous, and I believe that when you place a hyperdermic syringe in the hands of an employe he is liable to shoot something somewhere that would be more dangerous than if he would keep on the other side of the fence. As I said in the paper, it is not our purpose to make surgeons of these emergency men, but to teach them not to do what they do do. As the Professor said, with a man suffering from shock, with the vessels all turgid and thick, it is not prudent to raise him up and talk to him. Keep the other men away from him and give him a chance to get some good free oxygen and recover from the shock. Too much meddling does more damage to the injured than too little, they will infect the wound, and the instructions I have been trying to give are to cut the clothing off from a wound that is bleeding, but before they do that, to have your gauze ready to put on and get it covered quickly. And we do not have so many infected wounds now for that reason. And oftentimes, as I could refer to cases in preceding years, life has been sacrificed because of septic conditions from the wound, simply from some one running a chew of tobacco into it or tieing it up with a dirty handkerchief and covering it up with microbes and things which do damage in the wound.

In regard to some other little points which were brought out, I was very much pleased with Dr. Scott's remarks about adrenalin. As the Doctor has spoken of it, it is a power which we little know of to-day. But the worst cases of purpura hemorrhagia that I have ever seen, have been cured by that same remedy here in our hospitals. And while we have not been using it as the Doctor recounts, we have been having our eye on it, and I believe it is the coming remedy which will aid us very much in resuscitating the person from shock. But shock is felt often to be the result of hemorrhage, either internal or concealed, from any cause whatever, so that the first care we have to teach our employes is now to intelligently take care of what they can see, and intelligently let alone what belongs to the surgeon.

In regard to our friend Grooms, I like him, but his sympathy runs away with him once in a while, but it never runs away with him where the coin is. That never gets away from him. What I have to say in regard to that is only to correct an impression which I feel might throw discredit on the surgical history of the railroad company. He did not intend it so, but when he said that out of these men who were severely injured 100 stayed three months in the hospital, he meant three months wholly disabled. It is very seldom that we have a man that is in the hospital three months. Once in a while we do get a man that has to be there two or three months, particularly if he comes in suffering from a septic condition of the wound, it requires several months. But my friend will find when he looks over his cash account of this man charged up as having had an amputation in the middle of the thigh, going out of the hospital in 21 and 22 days, and a greater majority going out under five weeks, that they go out but little till they get new legs made, and that it is more than three months before they are able to return to the road.

Mr. Grooms: Yes, sir.

Dr. Milligan: Yes, it is six months or more. Now, in regard to certain little things in regard to the equippage of the road, I desire to state in answer to a little inquiry as to how the emergency boxes and stretchers, etc., were used in this system. It so happens that Mr. Turner, our worthy President, conferred with me and we designed and he made the first complete folding stretcher that I think was in existence. When it was ready to be placed in the baggage car, folded together, it only occupied twenty inches by four feet. That is all the room that is taken up. Enclosed in this folded stretcher are two woolen blankets and a rubber blanket, two splints, adapted for arms, and two for legs; enclosed within this stretcher is also our emergency box. The whole thing is compactly placed and brought together and is sealed by an ordinary car seal. There is a separate little box made in the baggage car and in the caboose where this stretcher is placed and secured from dirt, etc., by making it as tight as can be done. As soon as any emergency occurs in which any of these appliances are needed, that seal is broken and that stretcher and that emergency box goes back to headquarters to a gentleman under Mr. Turner's care, who immediately looks over it and renders it in perfect condition again by replacing what was lost and placing it back in its proper place, or else another one in stock is placed there, so that each caboose and each baggage car and each station and each telegraph station along the line has these different supplies, so that a surgeon if he is near the place of the accident, does not need to stop to run back after his satchel, for he finds everything there, and employes who are sufficiently instructed that he may be able to do that which is to be done before the surgeon arrives. All that is at hand. It is not usual for two head end collisions or two rear end collisions without one of the two baggage cars or two cabooses surviving, so that we always have emergency supplies on the spot, as we calculate, for six men. The box of supplies is ample for taking care of two men very badly injured, or three not so badly injured, and these boxes always being everywhere, and always to be found at the same place, it makes the matter about as convenient as it is possible to place it.

I thank you, gentlemen, for your kindness, and I hope at some future time to inflict on you something further in regard to this matter, relating to the humanitarian features of the case. And I think of all things on earth to the honest-minded man, the care that he gives to his injured fellow man is one of the noblest things he can do; and if there is a Heaven that a man can go to it is because he tries to do something for those around him. I thank you, gentlemen. (Applause.)

Chairman: Is there anything further?

Mr. Carson: I move that the Club pass a vote of thanks to Dr. Milligan, Dr. Scott and Mr. Grooms for the paper and the discussion, and the able manner in which they have been presented. It was certainly interesting and intelligent, and, unquestionably, we have all been greatly benefited by it.

The motion, being put, was carried unanimously.

President: Gentlemen, it gives me great pleasure to extend to you the thanks of this Club.

Mr. J. E. Simons: I thank you on behalf of my friend, Brother Grooms. He is a very modest man. (Laughter.)

A Member: There is one question I would like to ask before this subject is closed. Generally on freight trains six men compose the crew. How many of those are instructed in this first aid, and how are they instructed?

Mr. Turner: So far the instruction has not been carried any further than the printed instructions on the box. It was intended to call a certain number of men together at certain intervals and have them instructed by some one of the company surgeons; but since the first aid system was inaugurated we have been so busy and had such a roving class of men, generally speaking, that not very much has been accomplished in that direction. But it is expected as soon as we get settled down to a good working basis that all of our men who stay with us will receive instructions such as will enable them to handle an ordinary injury very intelligently.

If there is no further business, a motion to adjourn will be in order.

On motion, adjourned.

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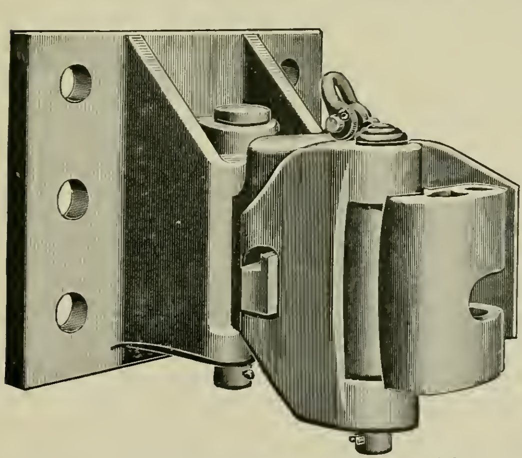

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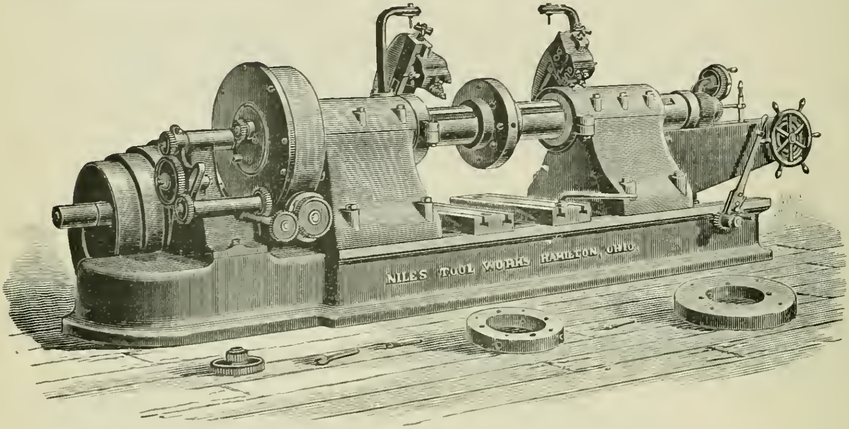
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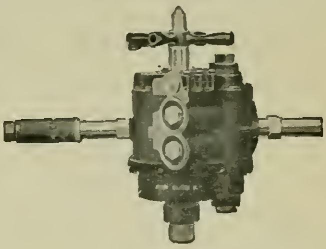

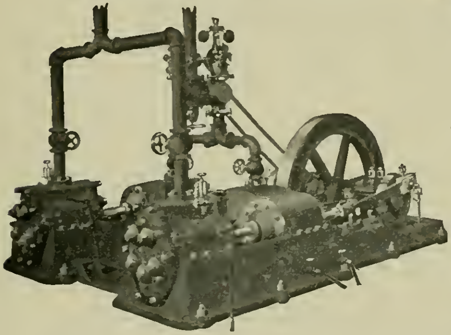

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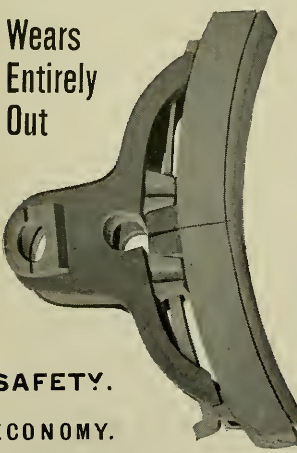

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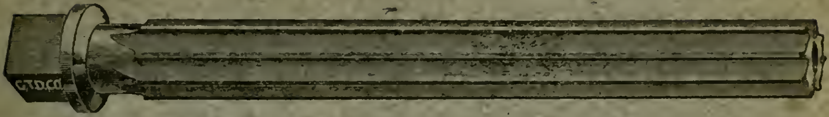

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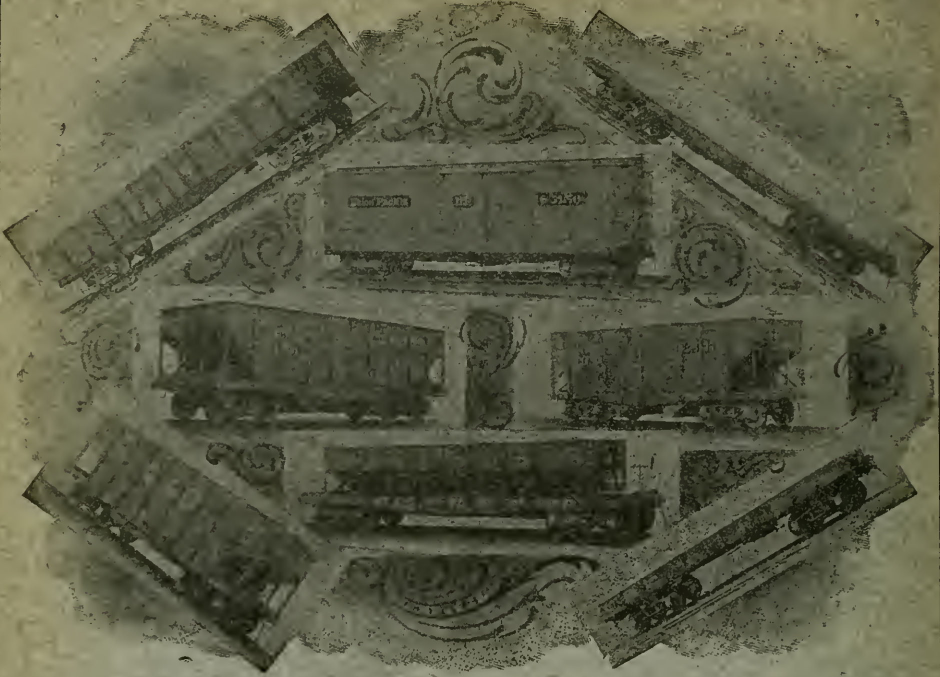

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OFFICIAL PROCEEDINGS

of the

Railway Club *of* Pittsburgh.

ORGANIZED OCTOBER 18, 1901.

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Manager American Locomotive Co., Pittsburgh, Pa.

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Supt. Motive Power, P. & L. E. R. R.
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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,

FEBRUARY 27, 1903.

The meeting was called to order at 8 o'clock P. M., at the Hotel Henry, Pittsburgh, Pa., by Vice-President L. H. Turner, in absence of the President.

The following gentlemen registered:

MEMBERS.

Anderson, Thos.
Bell, W. K.
Bowery, F. J.
Brown, John T.
Carson, G. E.
Conway, J. D.
Diamond, P. R.
Frost, Harry W.
Gies, Geo. E.
Greer, J. B.
Herr, E. M.
Hooff, J. L.
Hyndman, F. T.
Keppel, A. M. Jr.
Kessler, D. D.
Kirk, J. T.
Lane, F. W.
Lobez, Pierre L.
Malloy, M. A.
Maury, Geo. P.
McIlwain, H. M.
Palmer, Chas. A.
Raymer, A. R.
Reagan, P. J.
Redding, D. J.
Richardson, W. P.
Scheck, H. G.
Shannon, Chas.
Slocum, A. W.
Stark, B. F.
Stovel, R. W.
Summers, E. W.
Turner, L. H.
Weisbrod, J. F.
Wright, R. V.

VISITORS.

Herrman, Mr.
Knight, E. A.
Mitchell, Geo. E.
Murray, C. B.
McCaslin, A. W.
Smith, Sion B.
Weacherly, R. H.

President: As the minutes of the last meeting will be printed, we will omit the reading of the minutes.

The following gentlemen were elected to membership:

J. F. Coursin, General Foreman, P. R. R. Co., Pitcairn, Pa.

John W. Landis, Resident Manager, The Goubert Mfg. Co., Murtland Bldg., Pittsburgh, Pa.

Secretary Conway read a number of communications, among them the following:

THE MASTER CAR BUILDERS' ASSOCIATION,

Chicago, Ill., Jan. 31st, 1903.

Mr. J. D. Conway,
Sec'y Railway Club of Pittsburgh,
Pittsburgh, Pa.

Dear Sir:—

At a meeting of the Arbitration Committee held here yesterday it was suggested that the various Railway Clubs appoint their Committees on the "Revision of the Rules of Interchange" not later than the February meeting, and that the report of the Committee be considered at the March meeting, and the result of such consideration be transmitted to this office as soon thereafter as possible. The Arbitration Committee wishes to hold an early meeting on the subject of "Revision of the Rules of Interchange." I trust, therefore, we may receive your suggestions at as early a day as possible after the March meeting.

Yours truly,
JOS. W. TAYLOR,
Secretary.

On motion the Chairman is instructed to appoint a Committee of three to draw up notice to be sent to the members calling for suggestions.

The Chair appointed as this Committee, Messrs. F. H. Stark, of the Pittsburgh Coal Company; F. T. Hyndman, of the B. R. & P. R. R., and J. E. Simons, of the Hunt Foundry and Machine Company.

Secretary Conway: We have been unfortunate in the loss of one of our very prominent members, a man well known to all the members of this Club, Col. D. P. Jones. I think it would be appropriate that the Chairman should present the matter to you formally and have a Committee appointed to draft suitable resolutions expressing the sentiment of this Club.

On motion the Chair is instructed to appoint such a Committee, and appoints as that Committee Messrs. Wallace W. Johnson, of the Franklin Manufacturing Company; Francis

Colonel David Phillips Jones.

Colonel David Phillips Jones, Chief Engineer, U. S. N., retired, was born in Philadelphia March 15th, 1840 and died January 30th, 1903. He was educated in Philadelphia, and at the breaking out of the Civil War he entered the Engineering Corps of the Navy and filled many important offices until he was retired, owing to physical disability, in 1892.

He took part in several of the famous naval engagements of the Rebellion and at different times was on duty at the Bureau of Steam Engineering in the Naval Department, where his ability as a designer found ample scope. Colonel Jones was one of the fathers of modern engineering in the Navy. His most important work, however, was in connection with the founding and developing of the Engineering Department at the Annapolis Academy. After the Engineering Course at the Naval Academy was started, he became one of the professors in that institution where he was a most successful and popular instructor.

In 1898, when the Spanish-American War broke out, Colonel Jones was ordered on duty as inspector of steel in the Pittsburgh District, since which time he has resided in this city, enjoying a large practice as consulting engineer.

Colonel Jones' first wife was Miss Nellie Kellogg, of Erie, Pa., who died ten years ago. In September of last year, he married Miss Olive Harton, of Pittsburgh, who with one daughter of his first wife survive him.

Colonel Jones was one of the most lovable of men, a favorite wherever known, a raconteur of unusual ability, and a welcome guest at all social gatherings. He was an enthusiastic engineer, a good debater, and one who, as a member of this Club and a valued counselor and friend, will be greatly missed by all who knew him.

WALLACE W. JOHNSON,
FRANCIS W. LANE,
E. M. HERR.

W. Lane, of The Railway Age, and E. M. Herr, of the Westinghouse Air Brake Company.

President: The paper of the evening is on the Purification of Feed Water, by Mr. J. B. Greer, President of the Pittsburgh Filter Manufacturing Company. I have great pleasure in introducing to you Mr. Greer, who will kindly read his paper.

THE PURIFICATION OF FEED WATER.

BY J. B. GREER,

One of the most essential factors in the operation of steam boilers, is the quality of the feed water with which they are supplied. It matters not whether the boiler is of the stationary, locomotive, or marine type, the results which it produces as a steam generator, as well as its durability and safety, depend greatly on the purity of the water.

All natural water throughout the universe, contains mineral salts of some nature in solution, dependent on the character of the soil with which it is brought in contact. This is due to its solvent powers, and it will take up in solution any substance which it touches. If you put a quantity of lime in a pail of water, part of it is immediately taken up in solution. If a handful of nails is placed in a jar of water, iron carbonate is quickly diffused throughout it.

The impurities found in water are divided into three classes:

Scale forming.
Corroding.
Foaming.

These may also be sub-divided for convenience, as follows:

Scale forming solids embracing—

Calcium Carbonate.
Calcium Sulphate.
Calcium Chloride.
Magnesium Carbonate.
Magnesium Sulphate.
Magnesium Chloride.

Corroding Solids, embracing—
- Calcium Chloride.
- Magnesium Chloride.
- Free Acid.
- Iron Sulphate.

Alkali Solids, embracing—
- Sodium Salts.
- Potassium Salts.
- Chloride of Soda.

The scale forming ingredients constitute the most common and objectionable features in steam making, and are found in all waters in this country, except portions of the New England states, some parts of the South, and in parts of the Middle States, in such streams as have their origin in mountain districts. These waters rarely ever exceed 2½ grains per gallon of total solid residue, and boilers fed with such water are found to be in good condition after twenty-five to thirty years service. Some of the wells and rivers throughout the Middle and far West, exceed one hundred grains of impurities per gallon.

You are all familiar with the results arising from the use of such water. Had the designer of the steam boiler intended it to become enameled with that beautiful finish occasioned by the use of such a supply, he would certainly have provided more space for circulation.

It has been my duty of late years, to study the state of the art of water purification in the United States, in its different branches, and trace, step by step, its development from its earliest stages to its present satisfactory condition. In doing this, I have been much impressed by the fact that nearly all that has been accomplished in this country, both in studying existing conditions, and gathering the chemical and mechanical knowledge necessary to a solution of the problem, and in developing this knowledge, has been due to the continued and untiring efforts of two men, neither of whom has ever been fully rewarded for his efforts.

In the year 1841, Dr. Clark, of Aberdeen, Scotland, first discovered that fresh burned lime, mixed to the consistency of a milk or cream of lime, and introduced into water containing calcium or magnesium carbonate, precipitated these salts freely, by absorbing the excess carbonic acid gas which holds them in solution. By this means all the carbonate of calcium and magnesium is precipitated from the water, excepting only about 2½ grains per gallon, which remains dissolved and produces no trouble.

The other substances dissolved in water, which make it hard, are principally sulphate of calcium and magnesium, and these, with their allied compounds, may be taken out by adding a proper amount of sodium carbonate. The action of the dissolved sodium carbonate upon the dissolved sulphate of calcium or magnesium, is to exchange acids, giving carbonate of calcium or magnesium, insoluble compounds, which are immediately precipitated from the water, while the free sulphuric acid or sulphate of iron is neutralized. Mud and other impurities which are not dissolved in the water, but are in suspension, are carried down by the precipitate formed from the calcium and magnesium compounds. The application of this method was discovered by J. H. Porter, of England, in April, 1876, and is cited in British patent No. 1697. Up to this time, the process of purifying water had been carried on under the Clark process, but from the above date and up to the present moment, the success achieved in the art is directly traceable to the Porter-Clark system.

The Alkali properties which are so abundant in nearly all waters in the far West presents a different phase. While attempts have been made at its purification, and descriptions recorded in the trade journals, I am not at liberty to say that these results were maintained in practice. While the elimination of the scale forming and suspended impurities, goes far in preventing foaming in locomotives, I am led to believe that this difficulty will never be overcome by means of chemical purification.

The art of water softening, which was discovered more than sixty years ago, has had but a short period of usefulness in this country. In the year 1889, Armour & Co. erected a plant at Kansas City to purify, for boiler use, the well water on their premises. The apparatus employed was exceedingly crude when compared with modern devices on the market today. Certain results were attained, which in conjunction with a boiler solvent introduced with the feed water, caused them to continue its use for a number of years, until a new source of supply was obtained by establishing a pump station on the Missouri River.

About the same time the Proctor & Gamble Co., of Cincinnati, established a series of tanks in their works, to purify the water for their boilers. In this arrangement, the lime water was mixed and stirred by hand, and the water in the precipitation tubs was likewise agitated by muscle power. This arrangement was continued until three years ago, when a plant of more modern design was instituted in its place-

The art of water softening has reached a high state of perfection, and the apparatus now on sale leads the world in value and efficiency. There are two types of plants in use—the Continuous process and the Intermittent process.

In the former case, the raw water is passed through one or more tanks, and at the same time a proportionate amount of lime and soda is introduced with the water, and by passing it over a series of baffle plates, proper mixing and agitation is effected, so as to bring about precipitation. This water then passes through quartz filter beds, where every trace of suspended matter is removed, and a pure, soft water enters the roadside tubs, or clear water basin. While this process is looked upon with favor by some engineers, its range of usefulness is limited to certain classes of water.

The Intermittent type consists of two or more settling tanks, into which the raw water is pumped alternately, and after receiving its proper treatment, is agitated with air, and brought to rest. The precipitated deposit quickly settles to the bottom, and the clear soft water passes by gravity or pressure to the point of use. This system can be relied upon under all conditions, as a fixed quantity of water is always prepared with a certain amount of chemicals, and in case of a change in the raw water, can be corrected in each instance, either for an excess or an insufficient amount of treatment. Each day or hour, a test can be made in a few minutes of the raw water, and by referring to a table of quantities the exact amount of material can be used to bring about proper results. When a tank of water has been treated and agitated, a test is made of the purified water, and a uniform supply can thus be obtained. No water purification plant is so perfect as to accomplish human results. It requires care and good judgment on the part of the user. When I say results, I mean to reduce the impurities to three grains per gallon or less, and by so doing scale formations becomes an impossibility.

The methods employed for testing the raw or purified water each day are simple, and within the range of any ordinary workman. The variations existing in running streams from day to day, made it necessary to devise simple means, whereby the operator could be his own chemist, and vary his treatment accordingly. It is to be regretted that the use of water softening apparatus is so limited. At the present time there are not over two hundred plants in use in the United States, and these are to be found chiefly in manufacturing plants. The number of plants in use on the railroads of this country does not exceed thirty-five which represents about 15,000,000 gallons of water daily.

At present, no road has enough purifying plants to represent the possibilities of purification. If but one of the several water stations on a division is equipped with a plant, its effect on boiler repairs does not appear to advantage, because the treated water is mixed in the tender with the untreated water. Only when entire divisions are equipped, or at terminal points, where switch engines use the water exclusively, can comparisons be made.

I have made inquiries of six of the railroads in New England, regarding their water supply for locomotives, and I am not at all surprised at their replies. The general expression was that they had no bad water on their lines; that the life of a locomotive was upward of twenty years, that the flue mileage was in the neighborhood of 200,000 miles, and with a little caulking, would last for a like period of time. I also collected data from several lines operating west of the Mississippi river, and in comparing the average analysis of the two, it is not surpising to me that new side sheets and new fire boxes are required each year of service, and the flue mileage rarely ever exceeds 40,000 miles.

This is a strong argument in favor of water purification, as the results produced by the art of water softening in competent hands, has reached almost the final stage of perfection and cheapness, and a supply almost equal to rain water is the result to be expected.

Millions of dollars are spent annually by railroads, private corporations and municipalities in trying to avoid the installation of purification plants, by reaching out to obtain natural supplies either through expensive pipe lines, or storage reservoirs. This may give temporary relief, but as the area of the water sheds decreases, and the volume of contamination increases, the time is not far distant when every corporation or city will be obliged to resort to treatment of its water supply, and the expenditures for repairs for the steam user, and the fatalities from impure domestic supplies, will be reduced to a minimum.

A few days ago a prominent railroad official stated that the water supply on their line was better adapted for making a public highway, than for boiler use. In view of the present stage of perfection which this art has reached, is it not time to call a halt? Is it not time to "remove the cause" and stop the daily reports of delays and accidents due to bad water?

Magnificent locomotives—the pride of the builder, the idol of the engineer, and the admiration of the traveler, rendered completely powerless in a single day, due to impure water. Is it not time for the general manager to become cognizant of the fact, that all these troubles incident to bad water can be averted?

If I were a motive power official, I believe I would present to the general manager, on each holiday during the year, a souvenir from my department in the shape of a corroded sheet from the fire box, a sample of scale 1 inch thick, from the tubes, or a half dozen stay-bolts, 3 inches in diameter.

President: The subject is now open for discussion, and Mr. Greer will be glad to answer any questions any one may wish to ask. Mr. Raymer, you have looked into this subject quite a little, will you talk to us about it?

Mr. A. R. Raymer: I have heard this paper by Mr. Greer to-night with a great deal of pleasure and interest. I think our Club is under some obligations to Mr. Greer for this very interesting and able paper. I will not attempt to add anything to impress on you the importance of having proper feed water in our boilers, and I need not mention to you the effects of bad feed water on locomotives, because possibly all of you are better acquainted with that than I am. But I do wish to call your attention to an error that has been so long with us in connection with the use of bad water that possibly we do not associate them. I am firmly convinced that by the repeated washing out of a boiler by the process we are now using, that is, changing suddenly from the high temperature of working steam pressure, down to the cold washing water temperature, and then immediately up again to the high temperature due to the steam pressure, is a thing which is probably very ruinous to the structure of the boiler and possibly results in more leaking than it is given credit for. Our road has investigated this subject considerably in the past, and I might say that our people have decided to make some improvements in this direction.

There seems to be but one proper time for treating water successfully, and that is before it goes into the boilers. And there seems also to be but one method of treating the water, and that is by the use of lime water to throw down the carbonates and soda ash to throw down the sulphates, as has been pointed out by Mr. Greer. Our company is going into this at the present time, and we are installing a plant with a capacity of 1,500,000 gallons per day.

I would like to ask Mr. Greer a question, if you will allow me. On the 4th page of his paper he gave us the action of the soda ash on the water in throwing down the sulphates. He states that the acids are exchanged and calcium carbonate is thrown down, but no reference is made to what becomes of the sulphate. The presence of this sulphate has given us considable worry, because it combines with the soda, and makes sulphate of sodium, an alkali, which Mr. Greer speaks of in his next paragraph. From the best information I can get the concentration of about 175 to 200 grains of sodium sulphate per gallon approximates the foaming point or the condition where we expect trouble from foaming in the boiler. After looking carefully into the analysis of the waters we have on our road, (and you will excuse me for speaking of our own road, because I am more familiar with it than with others) from McKees Rocks to Youngstown we estimate that a locomotive starting from McKees Rocks yard and using purified water, going over the division and returning, 128 miles, will have in the neighborhood of 100 grains of sodium sulphate per gallon in its boiler. That means then that it will not be safe to allow this locomotive to make a second trip without the removal of the concentrated solution of sodium sulphate in the boiler. This brings up the question of blowing off and removing the water from the boiler and putting in fresh water again. The blowing off process has not been looked on with much favor on account of the difficulties heretofore experienced by particles of scale lodging or being liable to become lodged in the valves. Of course, you understand that with the new conditions, starting out with clean boilers there will be absolutely no scale thrown down, so there will be no reason for trouble on this account. So that will remove possibly one of the objections to blowing off. When using this purified water it will be absolutely necessary to get rid of the sodium sulphate.

Some of our people are undertaking a method of doing this by washing out and refilling at the temperature of working steam pressure. We are devising a scheme to accomplish this. It is not yet in operation, but it will soon be put in place.

I mention these facts so that Mr. Greer may possibly give us some light on them, as I assume that you want to know both sides of the question. After looking into this subject thoroughly and considering both sides, our company has decided to instal plants over the whole road, our decision is that these difficulties which I have mentioned are less troublesome than the difficulties which we now encounter with scale and acid.

There is another sentence on page 5 which I would like to emphasize, that is, that this treatment requires care and good judgment on the part of the user. We are convinced that this will be the case, and that it will be impracticable to instal a plant of this kind and expect it to operate itself or be operated without proper supervision.

The treatment of water, as Mr. Greer has said, has been reduced to a very simple science, and is so simple that an ordinarily intelligent pumper can take care of the whole process without any difficulty, and also take care of changes in quality or composition of the water. He is furnished with simple means of testing the water to see if he is overtreating it or under treating it. That part of it is a simple matter, and by giving it the same intelligence that we give to any other department of railroad work it is expected to be easily overcome. I might also say that our Company has gone to considerable expense in actually testing the water in some of the plants installed by Mr. Greer, and the results are as he says, good. Those who are using them are extremely well satisfied with them and state that their boiler repairs have been reduced to a minimum. I do not know that I can add anything further except to say that I am heartily in sympathy with those who are convinced that feed water treatment is necessary, and I believe that it will be considered good practice on all railroads very shortly.

Mr. J. B. Greer: Mr. Raymer has raised two very important points. When you treat water containing carbonate of lime with milk of lime you leave practically nothing there. The lime which is present in the solution, and that which you have added in the form of a milk of lime is all settled out and leaves nothing. But when you come to treat sulphate of lime and sulphate of magnesium it presents a different proposition. It is an exchange of acids. Sulphuric acid, which holds sulphate of lime and sulphate of magnesium in solution, has a greater affinity for sodium than for lime, consequently it forms sulphate of sodium in solution and carbonate of lime and magnesium in suspension. The carbonate of lime is thrown down, but the sulphate of sodium remains in the water and cannot be removed except by distillation. The question as to the amount of soda ash which a locomotive will carry I do not believe has been thoroughly estimated. When you go out on the western roads, I know of one test there made on the Rio Grande & Western a few years ago on a clean locomotive with purified water, and the claims which I have mentioned here were reported, but I did not see the test. They claimed that they ran something like 200 miles on the division on pure water, carrying it with them in a tank without any foaming. But our inquiry at the present time from the General Manager of that road elicited the fact that they experience a great deal of trouble from foaming, and in order to give the apparatus they have on their lines a good test, they established three or four additional plants, and that relieved the foaming. Now as I said, the sodium salts cannot be removed by any chemical process. The only thing you can do to obviate the trouble to a great extent is to treat the water at each station where the engine takes water, and by removing the scale forming properties you can carry a larger percentage of sodium salts than you can with the lime in. But so far as the amount a locomotive can carry is concerned I am unable to state. But I think that by treating the water between Pittsburgh and Youngstown as has been suggested at every station where the engine takes water, the boilers will not have to be washed out I would think until they had made several round trips.

Now the other point of making tests of the water, that is just as essential as the plant itself. Take a water softening plant and put it out four hundred miles from where you are, and you are liable to have about four telegrams a month telling you the plant is out of order and asking you to come and fix it or take it out, and when you get out there you find that they have changed the pumper, and the new pumper has never had any directions, and he says, "I am just doing what they told me." The result is that he is putting in 80 pounds of lime where he only needs ten for a tank of water, and the motive power man complains that his injectors are clogged up! To obviate this difficulty, I have devised tests for amount of carbonic acid in the water so that each pumper has his apparatus and his formula, and if he does not get that water right it is his own fault because any ordinary workman can use it. After the tank has been treated and agitated the plan is to have the pumper make a test of the purified water and bring his amount of scale-forming products down to three grains per gallon or less. I use a standard solution of soap for that so that a cubic centimeter of soap solution will precipitate half a grain of calcium carbonate in 100 cubic centimeters of water. Suppose he has got to lessen the water a grain and a half, he has his formula and he used so much material to each grain in 1,000 gallons of water. He puts that in and allows it to settle, and by following out that simple method there is no scale in the boilers.

Now take stationary plants. I have had more experience with stationary plants than I have with locomotives. The users of stationary boilers will put a man at this water softening plant, if he has about 5,000 horse-power, and keep him there twelve hours. He has a book and keeps a record of each tank of water that he purifies, and he knows exactly what he is doing. And it is far cheaper to keep two men there and keep his boilers running than it is to have five or six boiler washers and half a dozen men to make repairs, because the length of time between washing out will in ordinary conditions, run from three to four months. I have known boilers to run four months in the Indiana district on hard well water, carrying 25 grains of lime per gallon, without opening, and there was nothing in them when they were opened. I am sorry I did not have more time to go into this question in the preparation of this paper than I had. I would like you to see the records of plants, which I have from motive power officials on eastern lines in comparison with what they are doing out in the west. It is a great point for purification. But it is absolutely useless to purify the water at one station and then take bad water at the next. You can not show results either to yourself or to the man who installs your plant.

I have brought some samples of water here to-night that will give you an idea of the difference in quality.

(The speaker here illustrated the operation of the process on samples of water from the Allegheny river,from California, Colorado, Kansas City and Chicago.)

I think these few samples will satisfy most of you that there is more in this water than shows on the surface.

Mr. D. J. Redding: I do not like to overwork Mr. Greer, but I have not seen any of the water that bothers us in this district, that is the sulphur water from the Youghiogheny river.

Mr. J. B. Greer: I have a sample from the George's Creek Coal and Iron Company, which has considerable sulphur and iron in it. The treatment of waters containing sulphuric acid is the simplest proposition we meet, for the simple reason that you can remove it without causing any foaming. You can take out 25 or 30 grains of sulphuret of iron or free sulphuric acid with very little trouble by the addition of milk of lime. That can be done, either by a continuous or intermittent process with very good results and very cheaply. The waters which trouble us the most are waters containing sulphate of calcium and sulphate of magnesium, because it is the foaming properties that remain in those waters.

Mr. George P. Maury: I would like to ask Mr. Greer if the removing of the sulphuric acid is the simplest process he has in water purification? He says he cannot remove sulphates where he has a large quantity of calcium or magnesium sulphate; then he says, you can remove sulphuric acid by adding lime. I would like to have that explained.

Mr. Greer: I think the gentleman misunderstands me. The sulphate of iron and sulphuric acid are removed by adding milk of lime, forming calcium in suspension and a little of it in solution. The sulphate of calcium that is present in that water requires almost 100 ounces of soda ash to each grain of lime in 100 gallons of water. When you come to add the about six pounds that would amount to in 1,000 gallons you increase the amount of soda salt you have in your water. In the former case you do your work with lime and in the latter with soda.

Mr. Geo. P. Maury: You certainly neutralize your acid. But you form calcium sulphate which you do not get rid of. If you have Youghiogheny water this frequently contains 22 grains of acid in a gallon. If you add milk of lime enough to neutralize your free acid you will have in there 37 to 40 grains of calcium sulphate.

Mr. J. B. Greer: Not in solution, in suspension.

Mr. Geo. P. Maury: You get all your calcium sulphate in this district by calcium carbonate and sulphuric acid either added from the coal mines or the works along the river where they pickle iron for coating. There are plants in this district that are using many tons of sulphuric acid daily, which, after being neutralized, goes into the river as ferrous sulphate and reacts with the calcium carbonate of the river, forming calcium sulphate, which remains in solution. And it is as you state, if you put in soda salts once you can never remove it except by distillation. But if you have calcium sulphate you can treat that with barium carbonate and remove your sulphates, both sulphate of lime and free sulphuric acid.

Mr. Greer: But my experience has been that by adding just the proper amount of lime to the water the amount of sulphate of calcium produced in solition is so small that the positive impurification is practically nothing. The use of barium carbonate has not been to my knowledge very successful. It leaves chloride of sodium in solution. As a usual thing you have chloride of sodium instead of sulphate of sodium. The water along the river and in the mining regions has been treated very successfully by the addition of lime in the proper quantity and following with the sodium carbonate treatment to remove any that might be in solution. At No. 2 colliery of the Berwin-White Coal Company, where they have 152 grains of total solids, 40 grains of lime sulphate and 25 of free acid, and 12.90 of iron sulphate, they have been treating that water for five years to my knowledge and they have never put a hammer to their boilers, and theretofore they had been taking them out about every thirty days.

Mr. Geo. P. Maury: I understand that you can neutralize your free acid with lime or soda ash or with soda, but when you get a certain concentration you will get foaming; and you made the assertion that you remove your sulphuric acid by adding iime. Now sulphate of lime is soluble in 1 to 500. You take an ordinary precipitate of sulphate of lime and add 500 times as much water as you have sulphate of lime and you will have it all in solution, and that would make about 116 grains of sulphate of lime that will go in solution.

("Since the above discussion I have had occasion to neutralize a ferrous sulphate solution with lime and then determined sulphate of lime in the solution. After filtration it gave 114 grains per gallon in solution. Well, if you use the same amount of soda salts you are going to have foaming.")

Do not put it in to start with. You cannot get sodium chloride without you have some soda there to start with; and barium salts do not put any sodium in. If you treat it with barium salts you have sulphate of barium and carbonate of lime, both of which are insoluble, and you can easily filter them out.

Mr. Greer: Will the expense of barium salts at the present time admit of such extravagant use of it?

Mr. Geo. P. Maury: That is a question of how bad you want the water purified. Some people are doing it.

Mr. Greer: Yes, I have had that matter called to my attention during this past year. I built a plant in New Jersey where we had considerable sulphate of lime present and they wanted to use the barium salts, but after using the soda and lime treatment they got such satisfactory results that I heard no more of it. And as long as the price of barium remains as high as it is I do not think it will ever come into very popular use. I sent an analysis a few days ago to the United States Barium Company of Niagara Falls, and they declined with thanks to do it. It was one of the cases where we would like to do it but we could not. We would like to use it, but the amount of soda salts is so great that the cost is absolutely prohibitive.

A Member: The statement was made that an ordinary pumper could easily determine just how much to add to this water to bring down the solids to three or two and a half grains. I would like to know whether the man has to precipitate that and weigh it or whether you have some other test which can easily be applied.

Mr. Greer: We are having an apparatus made now by Sargeant of Chicago for that purpose, a short cut method for determining the amount of lime required so that the pumper can determine it; we are getting up a simpler method whereby he can do it more quickly and accurately. As soon as that is out I would be glad to exhibit the apparatus before the meeting.

Mr. D. J. Redding: You say it is an easy matter to remove the sulphuric acid and we should have no trouble with that. If that is the fact, that is where we get all our trouble here from the amount of acid water south of Pittsburgh that we have to contend with. We are willing to wash out our boilers occasionally and remove flues when they refuse to make steam. But you doubtless remember that the water at

West Newton, which is perhaps the worst water to contend with on the southern division of the P. & L. E., was for a year, and at the very time that method was going on more troublesome than anywhere else on the road. We thought we were doing very well if we got a locomotive to stay in service twelve hours. Do you know why we could not get better results at that time?

Mr. Greer: When that test was first started my recollection is that the treatment was mechanical. Afterwards it was put into tanks at West Newton. Was your trouble due to sulphuric acid or was it due to scale?

Mr. D. J. Redding: We had no scale there at all.

Mr. Greer: Then it must have been that the treatment was insufficient, because if you put the material into the water and bring about an alkaline reaction you ought not to have any corrosion. Now I have found on the Monongahela river that the interest taken in water purification is only during the times they have trouble. A great many of these plants that I equipped with apparatus to make tests were only used for a month or two in the year. They would have a rain or a freshet of some kind and thought all the acid was gone, and the first thing you knew they had corrosion. The trouble was they did not carry out these tests properly. At the present day there is no need of corrosion in boilers, and we are demonstrating that where we build a plant and run it and prove that corrosion need not exist where a man will look after it carefully. It is the simplest thing to remove, that there is, is simple sulphuric acid in water. It is only a question of getting people to look after it when they have their plants installed.

Mr. C. B. Murray: Although not a member of this Club yet. I wish to testify my appreciation of the paper just read. I am sorry that Mr. Greer hasn't said more about the Monongahela river water, as it is this water that gives many of us much trouble.

Although not connected with a railroad, yet for the last ten years I have had the treating of the water used in about twenty locomotives, and many stationary boilers at a large plant on the Monongahela river. (Note. The Edgar-Thomson Works.)

The one great difficulty in treating successfully this water, is its extreme variableness in acid contents. A locomotive taking water in the morning which may contain 0.3 of a grain of acid per gallon, taking from the same plug in the afternoon, may find 2 grains acid per gallon. Therefore, it is a difficult proposition to treat such water successfully.

For a number of years we used only lime, adding it directly in the tender and in the stationary boilers. During the last few years, however, we have used both lime and soda ash, the last year, in settling tanks.

While the Monongahela water is a sulphate water, that is, contains a large amount of sulphate of calcium and magnesium, with more or less free sulphuric acid, the Allegheny is a carbonate water, that is, contains carbonate of calcium and magnesium with small amounts of sulphates and, except in the vicinity of pickling works, no free acid.

It is a much simpler proposition, treating the Allegheny than the Monongahela water, for if you add lime to a carbonate water, the bulk of the scale-forming material, precipitates out and settles down.

One great disadvantage of the use of soda ash is the "foaming" which it causes. If, on the other hand, lime is used, we do away with the corrosion and foaming, but are troubled with scale. It is a question which you would rather have, the tubes eaten out or scaled.

Lime will neutralize all acid present and by using the phenolphthalein test, an excess may be avoided.

I do not agree with Mr. Greer that with the scale-forming material reduced to 3 grains per gallon no scale can be deposited on the tubes. Our treated water has been for months under 2 grains per gallon, yet scale has formed to the extent that it has been necessary to scale the tubes.

It must be remembered that every boiler full of water evaporated leaves behind the scale-forming material in that water, and this is never gotten rid of, except by washing out the boiler.

One difficulty occurs to me in the use of purifying tanks for locomotives along the road is that the reaction between the soda ash and the sulphates of calcium and magnesium takes place very slowly, unless the temperature of the water is above 100 degrees Farenheit, It takes time and a good deal of agitation for this reaction to take place in the cold. I would like to ask Mr. Greer, in his tanks, how long he finds it takes for this reaction.

Mr. Greer: Water containing a large amount of sulphate of lime must have more time to settle than water containing a smaller amount of carbonate of lime. In designing a tank to treat a bad water like the sample from Colorado it was necessary to use a tank of about twice the size we have used in the ordinary plant so as to give it time to settle. After the sodium carbonate is admitted to the water we agitate it with air or other means according to the circumstances, and we allow it to settle from four to six hours. We have no means to heat it, and we must let it precipitate in a cold state. We have had very good results in removing the lime and magnesium down to two grains per gallon, in fact in ordinary practice I do not think you will find it more than that in any plant.

Mr. E. M. Herr: I would like to inquire, since the point has been raised, about the comparative expense of the two treatments, with barium and with lime and soda ash.

Mr. Greer: I do not have any data except in one case. For every grain of sulphuric acid it required 3.2 grains of barium hydrate, and for every grain of sulphuric acid it requires a trifle over a grain of sodium carbonate, so that I should imagine it was about two or three times the expense of the sodium carbonate in treating the water.

A Member: What is the expense of the soda and lime treatment with ordinary water, say from 30 to 60 grains of solids?

Mr. Greer: That will depend on whether it is carbonate of sulphate. If you can do it with lime at from 25c to 40c per 100 pounds and 90c to $1 for sodium carbonate you can do it very much cheaper than you can with the barium process. The cost varies from 12c to 5c per 1,000 gallons. I have an analysis here of water at the Castalia Portland Cement Company plant at Castalia, O., which carries 39.68 grains of sulphate of lime, 6.72 of carbonate of lime and 6.77 of carbonate of magnesium. The cost of that at the present time is between 5c and 6c per 1,000 gallons. The usual rule is to take 2.9 ounces of lime to each grain of carbonic acid and 1.82 ounces of carbonate of soda to each grain of sulphuric acid for the precipitation.

A Member: I might add to what I said a few moments ago in connection with sodium sulphate in water that it has been found by actual experience that when a locomotive uses only treated water there is very much less trouble from foaming than when it uses water part of which is not treated. It appears that any such matter in suspension as mud will hasten the foaming condition. You might have a certain amount of sodium sulphate in the boiler and have no trouble with foaming and add some dirty river water and you would immediately have foaming. This has been the experience of some of the roads in the west, and that is also confirmed by laboratory tests.

Mr. E. M. Herr: I have had some twelve or fifteen years experience in railroad service on western roads between Chicago and the Pacific and I can fully bear out the statements which Mr. Greer has made as to the vile character of the water in some of the western districts. In fact he has not half stated the case as to what may be experienced in some of those districts.

The question of the use of soda ash and the amount of it that can be handled in a boiler when it is clean, is something that I have made a pretty careful study of at one time when I was on the Chicago, Milwaukee & St. Paul. We used soda ash with a great deal of satisfaction on both carbonate and sulphate waters. When we first used it we almost gave it up in despair because of foaming. But by constant and persistent washing of the boilers and varying the use of the soda ash we finally got those boilers clean, and it was found after they were entirely clean that we could use almost any quantity of soda ash in them without any trouble with foaming. In fact as an experiment I had an engineer take at one time a passenger train of I think five or six coaches, running on a pretty fast schedule, making a great many stops, and he went over his 100-mile run with a whole barrel of soda ash dumped into his tank, just to see what could be done. I would not have taken the responsibility to start him out that way, but he volunteered to do it. He had tested it from time to time, and he finally found that he could handle his engine satisfactorly with even that amount of alkali. I cite that as an instance of what can be done with a large amount of alkali in the water if the boiler is perfectly clean.

Mr. F. H. Stark: This is a wholesome subject for railroad men to consider, and I believe it will have the effect of creating sentiment possibly in drinking water—excepting in Milwaukee, St. Louis and Pittsburgh. I believe that improvements of this kind have to be brought about in this way. The railroads are very slow to spend large amounts of money for improvements of any character, and it is by discussion in Railway Clubs and Mechanical Engineers' Societies, etc., that it is brought to the attention of the powers that be. I am very much interested in the subject, and I believe we should extend a vote of thanks to Mr. Greer for this able paper. I make a motion to that effect.

Mr. A. W. Slocum: I would second that and add also "for the pleasant and able manner in answering all questions."

The motion as amended prevailed unanimously.

Mr. J. B. Greer: Gentlemen, I appreciate what you have said. I would like at some future time, after we have made a few more experiments in some railroad plants that we have installed, to give you the benefit of our experience, and I would like to have any one interested go with me to these plants.

I thank you all for the courtesy extended.

On motion, adjourned.

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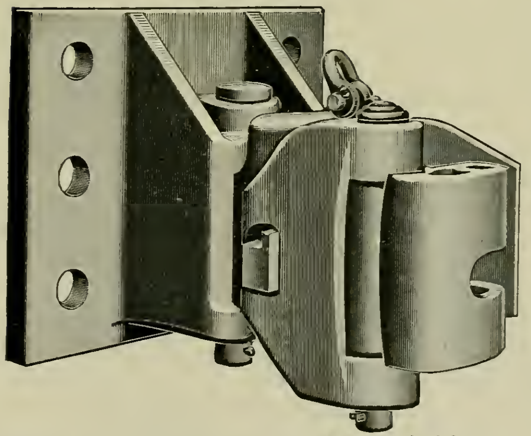

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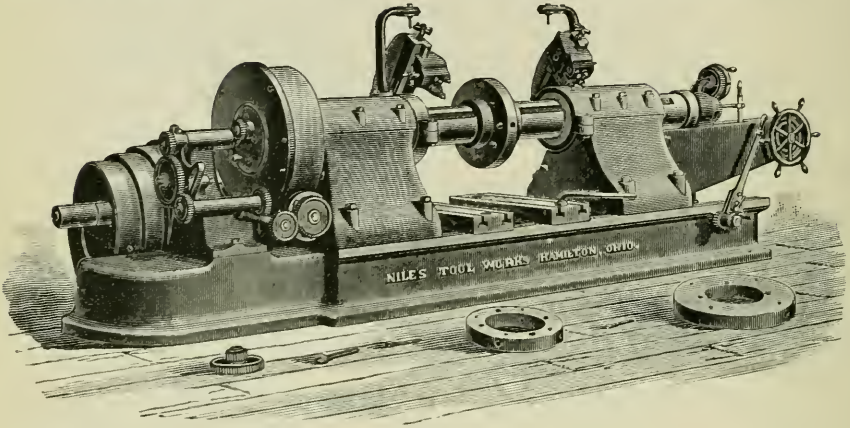
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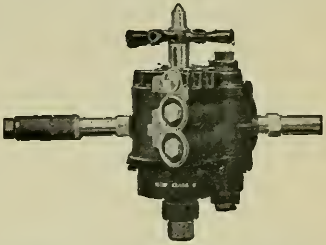

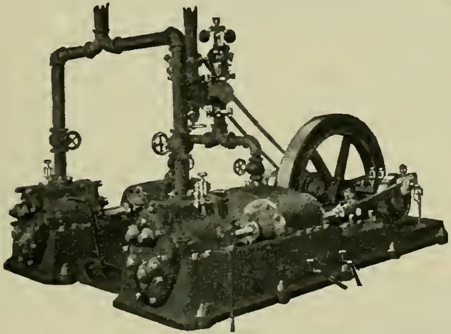

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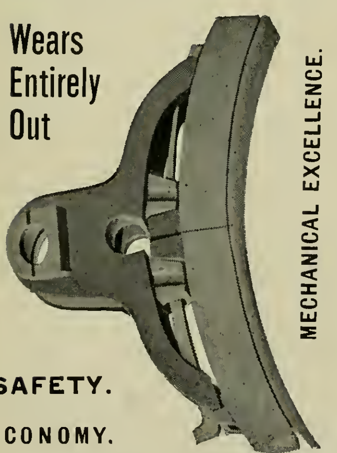

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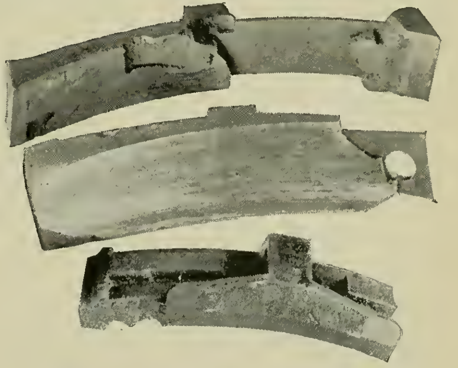

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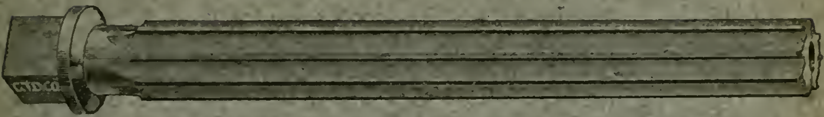

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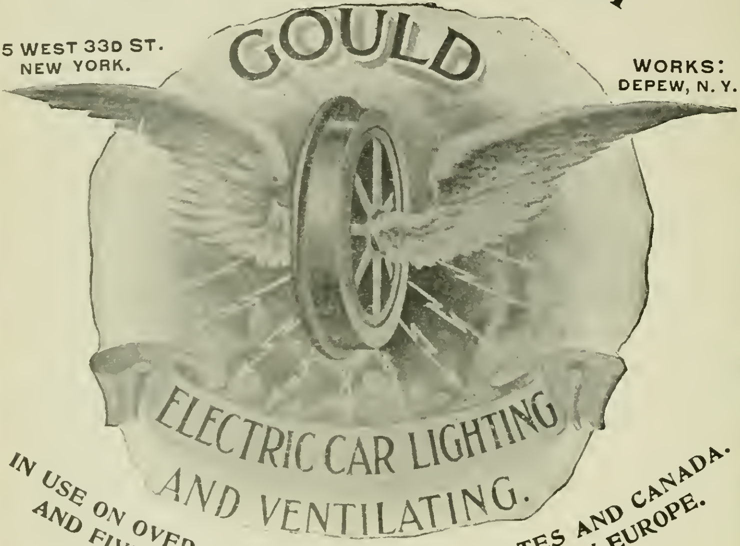

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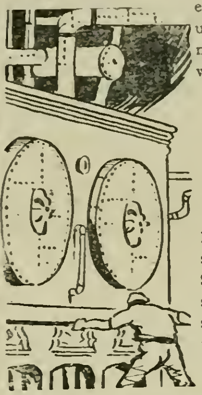

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of the

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ORGANIZED OCTOBER 18, 1901.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,

MARCH 27, 1903.

The meeting was called to order at 8 o'clock p. m. at the Hotel Henry, with President J. H. McConnell in the chair.

The following gentlemen registered:

MEMBERS.

Anderson, Thos.
Bartley, Milton.
Bellows, A. B.
Bonsall, J. S.
Carson, G. E.
Conway, J. D.
Currie, J. C.
Diamond, P. R.
Dow, G. N.
Fitzgerald, Orrin.
Flinn, C.
Gies, Geo. E.
Hare, John.
Hastings, C. L.
Hobson, Bailey E.
Holbrook, D. O.
Howe, D. M.
Hukill, J. L.
Hunter, H. S.
Hurley, J. L.
Hyndman, F. T.
Johnson, A. B.
Keppel, A. M., Jr.
Kessler, D. D.
Keys, S. B.
Knight, E. A.
Lindstrom, Chas. A.
Lininger, W.
Lobez, Pierre L.
Long, Chas. R., Jr.
Low, Edgar S.
Macoubray, R. J.
McConnell, J. H.
McCracken, Jno.
McIlwain, J. D.
McKee, S. Frank.
Noble, D. C.
Palmer, Chas. A.
Pelletier, Louis.
Postlethwaite, C. E.
Proven, Jno.
Rank, O. P.
Redding, D. J.
Richardson, W. P.
Riley, J. W.
Searles, J. R.
Searles, E. J.
Shepard, L. A.
Sherman, C. W.
Simmons, W. M.
Simons, J. E.
Slocum, A. W.
Stark, F. H.
Stark, B. F.
Stucki, A.
Summers, E. W.
Sweeley, G. P.
Tesseyman, J. E.
Thomas, Richard L.
Turner, L. H.
Turner, Alexander.
Watts, H. W.
Warne, J. C.
Weisbrod, J. F.
Whinery, S. B.
Whitridge, J. C.
Wright, R. V.
Wright, Wm.

VISITORS.

Anderson, H. T.
Barclay, James B.
Beecher, H. E.
Berkebile, P.
Bissell, F. B.
Blest, M. C.
Bostwick, H. M.
Cox, Geo. W.
Dodds, Ethan I.
Elverson, Howard W.
Fisher, H. B.
Gillen, John.
Gulick, Henry.
Gulick, H., Jr.
Harrison, F. J.
Johnson, Jno. F.
Lysinger, J. M.
Morris, Lindsay.
Moyer, F. H.
Ostrander, A. E.
Phelps, W. G.
Reed, James.
Smith, D. W.
Smith, Sion B.
Streib, J. F.
Tinstman, B. E.
Weidlein, J. P.
Wilder, Ralph E.
Wilkinson, R. H.

The list of applicants for membership was read by the Secretary as follows:

Geo. M. Kerr, representing Berry Bros. of Detroit, Mich.
R. M. Long, Assistant Traveling Engineer, P. & L. E. R. R. Co., McKees Rocks, Pa.
W. O. Quest, Foreman Painter, P. & L. E. R. R. Co., McKees Rocks, Pa.
A. W. McCaslin, Foreman Blacksmith, P. & L. E. R. R. Co., McKees Rocks, Pa.
Alexander Carney, S. M. P., B. & O. R. R. Co., Pittsburgh, Pa.
J. E. Searles, Assistant S. M. P., B. & O. R. R. Co., Pittsburgh, Pa.
John F. Lanfersick, Foreman Painter, P., C., C. & St. L. Ry. Co., Columbus, Ohio.
W. G. Hall, Clerk, P. & L. E. R. R. Co., Pittsburgh, Pa.
B. F. Wynn, Master Painter, P. R. R. Co., Pitcairn, Pa.
Geo. M. Oates, Foreman Painter, Pressed Steel Car Co., No. 16 Lillian street, Pittsburgh, Pa.
John C. Whitridge, Assistant General Manager Buckeye Malleable Iron & Coupler Co., 42 Lexington avenue, Columbus, Ohio.

L. A. Shepard, M. E., 100 Broadway, New York.

J. B. Marshall, Manager Union Forge Co., Pittsburgh, Pa.

A. A. Cohill, Engineer, Standard Steel Car Co., Butler, Pa.

Thos. J. O'Brien, Superintendent of Construction, Standard Steel Car Co., Butler, Pa.

J. F. Mechlin, Assistant M. M., Pittsburgh Division P. R. R. Co., Wilmerding, Pa.

E. A. Knight, Assistant General Foreman, Pennsylvania Co., Allegheny, Pa.

President: When these names have been approved by the Executive Committee these gentlemen will become full members of the Club.

Mr. F. H. Stark, of the Committee on Report of Master Car Builders' Association, reported as follows: "The circular was addressed to each of the members, but on account of the rules giving such entire satisfaction not a single recommendation was offered. I believe, however, that it would be well for the Club to put itself on record in some particular. It was thought that the Arbitration Committee might consider the question of providing a price in the M. C. B. rules for steel cars of various classes. As it is now these cars must be settled for on the composite car basis. I believe that the M. C. B. A. could well consider the question of prices for steel car repairs. The work is being done quite extensively on some of the larger systems. At Baltimore the B. & O. repair nearly all the cars for the entire system at that one point, and have established piece work prices for steel car repairs.

In order to get this subject before the Club, I move that it is the sense of this Club that the Arbitration Committee consider the question of prices for steel cars, and that the subject of steel car repairs be made a special subject for the following year.

Mr. H. W. Watts: There is a committee of the M. C. B. A. now that has under consideration that very subject.

Mr. Stark: I believe that circular refers to the price of cars and not to the price of repairs of cars.

The motion being put, was carried unanimously.

On motion of Mr. J. E. Simons the following resolution was adopted:

Resolved, That the thanks of the Railway Club of Pittsburgh be tendered to the Pressed Steel Car Co., and also to the P. & L. E. R. R. Co. for the courtesies extended by them this afternoon, whereby the members of the Club were enabled to spend a very pleasant and beneficial afternoon visiting the works of the Pressed Steel Car Co.

Secretary Conway announced the death since the last meeting of a member of the Club, Mr. Elmer Scott Mason, assistant to the purchasing agent of the P. & L. E. R. R., whereupon the Chair appointed the following committee to draft suitable resolutions: R. Evans, J. L. Hukill and L. H. Turner.

On motion of Mr. W. M. Simmons the Secretary is deputized to represent the Railway Club at the M. C. B. convention at Mackinac Island in June; and that this be a permanent yearly appointment.

The paper of the evening was read by Mr. E. W. Summers, as follows:

E. Scott Mason.

Death, the dreaded foe of mankind, has entered our ranks and removed with suddeness from our circle, Mr. E. Scott Mason, Chief Clerk to the Purchasing Agent of the Pittsburgh & Lake Erie R. R. Co., and an honored member of this Club. Therefore, be it

Resolved, That the members of the Railway Club of Pittsburgh, hereby offer this humble tribute to the memory of our departed friend, and tender our sincere condolence to the family of Mr. Mason, and that these resolutions shall be spread upon the minutes of this Club, and a copy sent to the family of the deceased.

RAWDON EVANS,
J. LAYNG HUKILL,
L. H. TURNER,
Committee.

STEEL CARS WITHOUT CENTER SILLS.

BY MR. E. W. SUMMERS, STRUCTURAL ENGINEER.

The Steel Car is practically in its infancy. Of the one million four or five hundred thousand cars in use in the United States, only about one hundred thousand are of steel. The majority of these have been built in the last two or three years, and six years ago the steel car of to-day was unknown.

It is true that Iron Cars have been in use in some of the European Countries for a much longer period, but for size of car and load carried there is not much in common with the American steel car.

With all due honor to those who have brought about the wonderful results thus far attained in steel car building, it is thought that not enough attention has been given to the functions of some of the members in the framing of a car. Many of the railroad managers are exceedingly lax in their demands for a careful analysis of the stresses set up in a car due to the known loading. This is not so strange when we consider that the construction of cars began before the discovery of the methods of computing stresses in framed structures, and that by experiment and additions of material here and there where failures took place, the development of the wooden car of today has been brought about.

The writer is of the opinion that with the change of material from wood to steel the general arrangement of the framing members has been too closely followed, and that a very material saving may be had by following other lines which will simplify the construction and eliminate ambiguity.

One radical change to be suggested is doing away with the centersill in cars of all steel contruction, as it is largely a redundant member which adds weight to the car, with little or no advantage. This is especially true in gondola cars and hopper cars. The M. C. B. standard height for couplers and the location of the car floor and truck render it necessary to make the centersill a comparatively shallow beam, which is at the expense of material and weight.

If we increase the depth of the beam in the central part by adding to its lower side, making it a fish belly shape, the line of force due to the heavy buffing at the couplers is near its upper edge. This acts in conjunction with the compression in top flange from the vertical load, increasing the section required.

The side retaining walls of a car have position and depth well adapted to economically carry the vertical load, and, with its location above the line of the buffing force on the couplers, the compression due to buffing is counteracted by the tension in the lower side of the girders from the vertical load. In most cases, the material required for the stresses from the vertical load need not be increased to take care of the buffing force.

The tugging forces are limited and small compared with the buffing force, and in many cases the floor plates will transmit this stress without it reaching the side girder.

The advantage of a deep girder for economy is so well known that the writer does not think it necessary to give space for its discussion in this paper.

In a Gondola Car without centersills, the transmission of the buffing and tugging stresses from the draft sill to the side girders, is accomplished through the medium of the floor plates, which have a superabundance of material for this purpose.

We must not be misled by the kind and color of the paint on a car. The light weight and capacity marked on the car side may have little or no bearing upon the intensity of the stresses to which its material is subjected. A car may be loaded to its marked capacity and be working some of the material almost to the danger point, and yet be undiscovered until it shows up in the short life of the car, or of some of its parts. On the other hand, some parts of a car may be excessively heavy and subject to little or no strain, A CON-

DITION WHICH WOULD NEVER BE DISCOVERED BY FAILURE.

In a building or fixed structure having excessive and useless material, we lose only in the cost of production, as it will stay there by its own inertia, but in a car we have the continual expense in moving this material over the tracks, which may be enough to pay interest and principal on the cost of the car and keep it in repair.

In order to exemplify the saving that may be had by arrangement of material, a comparison of stresses, deflections, etc., is here made with cars of same marked capacity, and under the same condition of lading, selecting for this purpose the following steel gondola cars:

FIGURE 1 is a cross section near center of a Philadelphia & Reading Railroad Car—

100,000 lbs. capacity. Weight, 33,400 lbs.

FIGURE 2 is a cross section near center of a Pennsylvania Railroad G. S. Car—

100,000 lbs. capacity. Weight, 38,800 lbs.

FIGURE 3 is a partial plan and sectional elevation of a car 100,000 lbs. capacity, without centersills. Weight, 33,800 lbs. Author's design.

FIGURE 4 is a vertical cross section in this car at two points as indicated.

The load for all cars will be:

Live load ....100,000 lbs.

Dead load equals two-thirds weight of car body.

For impact add 50 per cent. of the live and dead load.

All of the above to be distributed on that part of the car between the bolsters.

And in conjunction with the above vertical load, a horizontal buffing force of 300,000 lbs. is to be taken on the couplers.

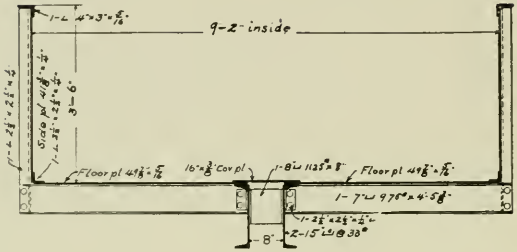


Fig. 1.

STRESSES AND DEFLECTIONS.

Philadelphia & Reading Car (Figure 1.)

Size 34 ft. 0 in. x 9 ft. 2 in. x 3 ft. 6 in. inside measurement.
25 ft. 6 in. center to center of trucks.

Light weight	33,400 lbs.	
Trucks weight say	15,000 lbs.	
Net weight car body	18,400 lbs.	
Live load		100,000 lbs.
Two-thirds weight of car body		12,260 lbs.
Their sum		112,260 lbs.
Add 50 per cent.		56,130 lbs.
Final distributed load		168.390 lbs.

168 390 divided by 2 equals 84,195 lbs. load on center-sills.

84,195 divided by 2 equals 42,097 lbs. load on each side girder.

Maximum moment on centersills equals 3,170,000 inch lbs.

Maximum moment on each side girder equals 1,585,000 inch lbs.

For centersills counting with the channels 16x⅜ inch cover plate, and say, 6 inches of floor plate on each side, S. equals 87.

For one side girder counting say 6 inches of floor plate as acting with the girder, then S. equals 155.

3,170,000 divided by 87 equals 36,500 lbs. per square inch—centersills.

1,585,000 divided by 155 equals 10,200 lbs. per square inch —side girder.

DEFLECTION UNDER THIS LOAD.

Center sill deflection equals	1.215 inches.
Side girder deflection equals	.155 inches.

It looks like the cross beams should be hinge connected to center and side sills. With the prohibitive stress of 36,500 lbs. per square inch on the centersills due to the vertical load alone, and the extending effect of the tension edge of the side girders attached to the floor plate, holding the ends of the center sill apart, it is evident that any tugging force on the couplers must also be taken on the centersills, increasing the above stress, while buffing blows on the couplers WILL BE RESISTED BY SOME OTHER PART OF THE STRUCTURE.

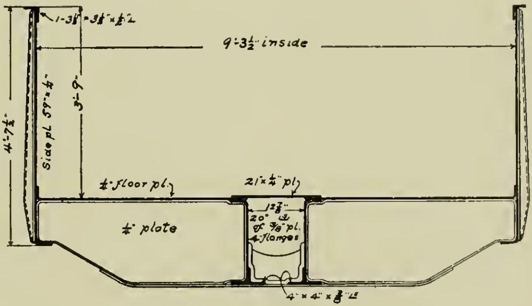


Fig 2.

Penna. R. R. Gs. Car (Figure 2.)

Size 38 ft. 2½ in. x 9 ft. 3½ in. x 3 ft. 9 in. inside measurement.
30 ft. 0 in center to center trucks.

Light weight	38,800 lbs.
Truck weight	16,000 lbs.
Net weight car body	22 800 lbs.

Live load	100,000 lbs.
Two-thirds weight of car body	15,200 lbs.
Their sum	115,200 lbs.
Add 50 per cent.	57,700 lbs.
Final distributed load	172,900 lbs.

In this car the difference in depth of the centersills and side girders would, as in the Philadelphia & Reading car, produce a widely varying deflection, had not this been taken care of by providing deep cross beams framed into the centersills, with cover plate top and bottom holding them all to practically the same deflection. This deflection equals .216 inch for all beams, and will require 13.05 per cent. of the load for the centersills and 86.95 per cent. for the side girders to produce this deflection, giving—

23,000 lbs. for centersill load,

150,000 lbs. for girder load, or

75,000 lbs. on each side girder.

Maximum moment for centersills equals 1,028,000 inch lbs.

Maximum moment for one side girder equals 3,380,000 inch lbs.

For centersill, counting 33x¼ inch cover plate on top of channels as part of sill, this includes 6 inches of outstanding floor plate on each side. S equals 204.

For side girder, including also 6 inches of the oustanding floor plate S. equals 256.

1,028,000 divided by 204 equals 5,000 lbs. ext. fiber stress centersills.

3,380,000 divided by 256 equals 13,200 lbs. ext. fiber stress side girder.

With the vertical deflection of .216 inch, as given above for the centersill and side girder, the top flange of the centersill is shortened .046 of an inch, and the lower part of the side girder (where the floor plates are attached) is lengthened .086 of an inch in the 30 feet between bolsters. Since the centersills and side girders are attached rigidly to the floor plate, there is an apparent difference in length in the center and side portions of the floor plate equal to the sum of .046 inch and .086 inch or .132 inch; that is, the central portion is apparently drawn in .132 inch shorter than the outer edges of the floor plate; or, in other words, the floor plate at each end of the car must deflect edgewise toward the center of the car an amount equal to one-half of .132 inch, or .066 of an inch, but the floor plate from the end to center of car is a little over 19 feet. This is quite a deep beam in which to expect such a deflection, when its length is only 9 ft. 4 in (the width of the car). Suppose we consider a depth of only 12 feet and see how much deflection we will get with a force of 300,000 lbs, applied at the center, or on the coupler, and resisted at the sides of the car. We then have a plate ¼ inch thick by 144 inches deep by 112 inches long, I equals 62,208.

$$\text{Deflection}\frac{300{,}000 \text{x} 112 \text{x} 112 \text{x} 112}{48 \text{x} 29{,}000{,}000 \text{x} 62{,}208} \text{ equals } .0048 \text{ inches.}$$

This is only about 1-13th of the above .066 of an inch.

It is probable that this whole change of .066 has not taken place in the floor plate, but that the members tending to produce this edgewise deflection have given sufficiently to accommodate themselves to the rigidity of the floor plate, and that the whole cross section of the centersill is in tension at some point between the bolsters, even with a much greater buffing force than 300,000 lbs.

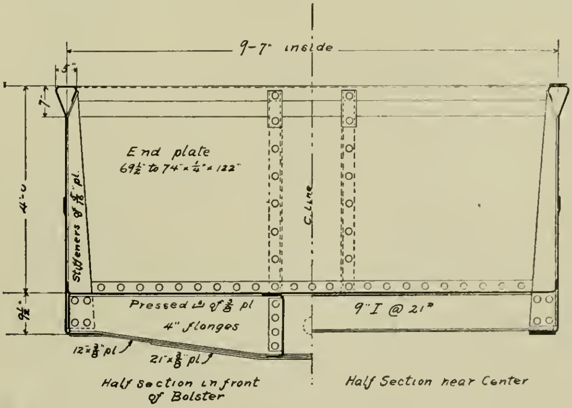
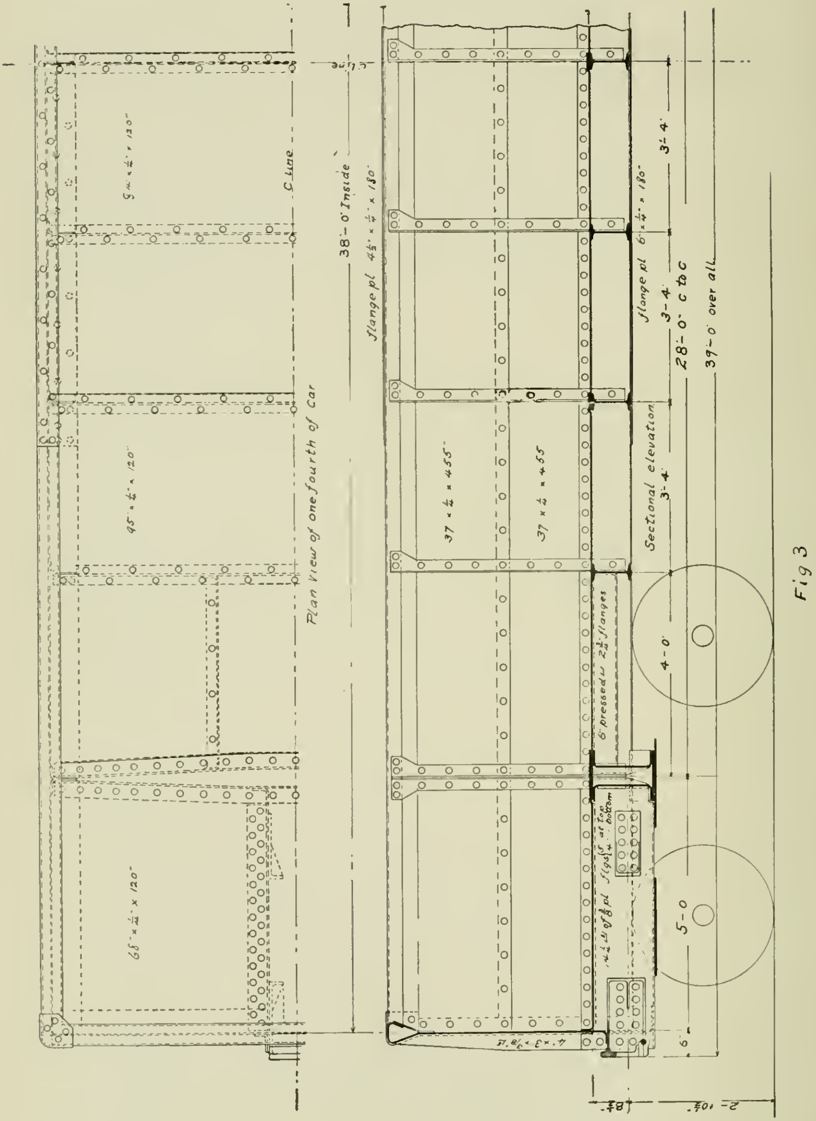


Fig 4



E. W. Summers' Car (Figures 3 and 4.)

Size 38 ft. 0 in x 9 ft. 7 in. x 4 ft. 0 in. inside measurements.
28 ft. 0 in. c. to c. trucks.

Light weight ....33,800 lbs.
Trucks weight ....16,000 lbs.

Net weight of body....17,800 lbs.
Live load ....100,000 lbs.
Two-thirds weight of car body........ 12,000 lbs.

112,000 lbs.
Add 50 per cent. .... 56,000 lbs.

Final distributed load.............168,000 lbs.

In this car having no centersills the WHOLE load must be carried on the SIDE GIRDERS, giving 84,000 lbs. for each girder.

Maximum moment for one girder equals 3,530,000 inch lbs.

For one side girder counting 6 inches of the outstanding floor plate as acting with the girder S. equals 320 for the top portion and 361 for the bottom.

3,530,000 divided by 320 equals 11,050 lbs., extreme top fiber stress.

3,530,000 divided by 361 equals 9,800 lbs., extreme bottom fiber stress.

In this car we have the same conditions of floor plate for transmission of the buffing stresses to the car sides, as in the other two cars. With a buffing force of 300,000 lbs. on the couplers, there is a maximum compression in lower flange of side girders of..............10,900 lbs. per square inch.
Tension stress due to dead weight
of car .... 740 lbs. per square inch.

Resultant stress with car empty..10,160 lbs. per square inch.

WITH BOTH BUFFING AND VERTICAL LOAD

Compression.10,900 lbs. per square inch from buffing.
Tension ..... 9,800 lbs. per square inch from vertical load.

1,100 lbs. per square inch equals resultant stress.

COMPARATIVE STRESSES.

		Philadelphia & Reading Car.	Penn'a R. R. Gs. Car.	E. W. Summer's Car.
Light weight of car		33,400 lbs.	38,800 lbs.	33,800 lbs.
Cubic ft. in car with 30° heap		1,460	1,764	1,918
Maximum capacity coal @ 52 lb. per cubic feet		75,920	91,728 lbs.	99,736 lbs.
Ratio paying load of coal to total weight		69.5%	70.2 %	74.7 %
Stress from 100,000 lb. load, plus ⅔ the weight of car body, with impact as stated above	Side Girder	10,200 lbs.	13,200 lbs.	11,050 lbs.
	Center Sills	36,500 lbs.	5,000 lbs.	No Center Sills
Extreme fiber stress per square inch in side girders when resisting 300,000 lbs. buffing load		Compression, 24,000 lbs.	Compression, 13,650 lbs.	Compression, 10,900 lbs.
Resultant stress per square inch in side girders from buffing and vertical loads combined		Compression, 15,500 lbs.	Compression, 450 lbs.	Compression, 1,100 lbs.

From the preceding table of comparative stresses the following conclusions may be drawn:

1st. The Philadelphia & Reading Car, built for a coal road, will only hold about 75 per cent. of its marked capacity in coal, and when loaded to its marked capacity shows excessive stresses.

2d. The Penna. R. R. Car was evidently conscientiously built for heavy and rough service. The stresses from the load all indicate ability to survive the work, but, with the center-sills weighing almost as much as both side girders, carrying only about one-eighth of the vertical load and little or no buffing load, what is it there for?

3d. The Summers Car, having no centersills and weighing 5,000 lbs. less than the Penna. Car, is capable of resisting the same loads vertical and horizontal, with a lower fiber stress in the critical material and a greater percentage of revenue freight to total weight.

President: We have with us this evening Mr. A. B. Bellows, Vice Chairman and Manager of the Pittsburgh Testing Laboratory, Limited, and he has kindly consented to discuss this question for us.

Mr. A. B. Bellows: Mr. President and Gentlemen: I have read with great interest Mr. Summers' paper.

I think it would have been only fair and more interesting to have stated the actual specifications under which the Philadelphia & Reading and the Pennsylvania Railroad cars were designed and built, and the service for which they were intended, rather than to have made arbitrary assumptions. I think I shall be able to show that the strains which Mr. Summers has given for the Philadelphia & Reading car are not correct, nor are they the strains that actually occur under proper assumption of loading.

The car was not designed as an out and out coal car, as the depth of the sides clearly indicate, but as a general utility car, capable of carrying pig iron, limestone or other loads, which are as a rule piled over or in the vicinity of each body bolster. Moreover, when it does carry coal, it is hard coal, which weighs about 15 per cent. more than the soft coal of this district.

Mr. Summers assumes a uniform load of 100,000 pounds between the body bolsters, but has not any load between them and the ends of the car. (See Figure 5.)

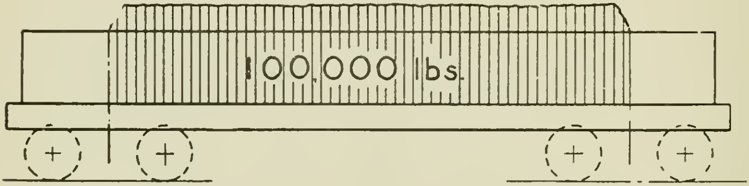


Fig. 5.

This is very unusual, as it is customary to figure 110,000 pounds (marked capacity plus shipper's 10 per cent. excess), as being uniformly distributed from one end of the car to the other. (See Figure 6.) In fact, if the load is to be coal it will have to be distributed in this manner. In case of the Pennsylvania's car I think that has been figured for a uniform load from end to end of 125,000, which gives about 85,000 between the bolsters instead of 100,000, as given in Mr. Summers' paper. In practice it is not customary to put the entire load in the center of the car, and a railroad company would undoubtedly refuse to take a car loaded in this manner.

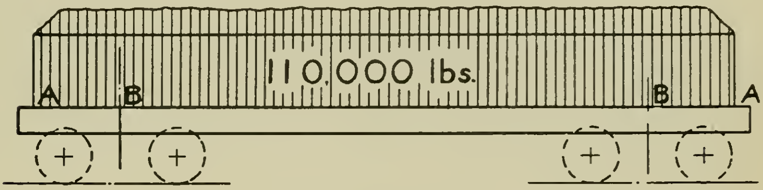


Fig. 6.

In the case of figure 2, there is a negative bending moment, caused by the load between the body bolsters, B, and the ends of the car, A. Mr. Summers does not figure or mention this moment.

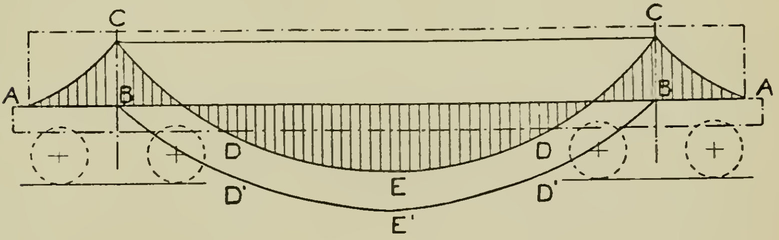


Fig. 7.

Note.—Curves in Fig. 7 are merely conventional.

This can be better shown by a sketch. (See Figure 7.) AC is a parabola and ABC represents the negative bending moment at B. The parabola DED represents the bending moment if 100,000 pounds was between the body bolsters, while the curve CDEDC represents the bending moment if the negative bending is taken into account. In other words, the load between the body bolsters and the ends of the car reduces the effect of the load in the center of the car. In the case of the Philadelphia & Reading car this is quite an item.

The specifications for this car call for a maximum strain of 14,000 pounds per square inch, but no allowance is made for impact. Under these conditions the maximum strain in center sill is 13,840 pounds tension in bottom flange. The compression is 7,780 pounds in the bottom flange. The Cambria Steel Company, builders of this car, figure, as a rule, 25 per cent. impact on sills, when it is left to them. If we add 25 per cent. impact in the above case, as I consider 50 per cent excessive, and take into account the negative bending moment, we have as the maximum tension 17,300 pounds, and as the maximum compression 9,730 pounds. This is considering the vertical load of the car without any buffing strains.

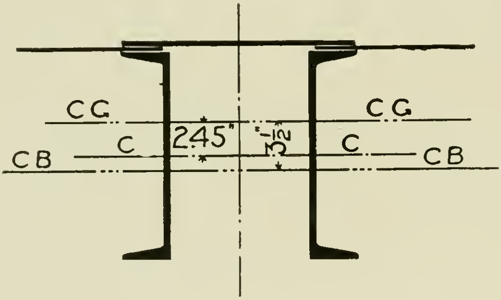


FIG. 8

One of the peculiar things about the center sill of the Philadelphia & Reading car is that the section consists of two channels with the floor plate on each side and a cover plate on the top. (See Figure 8.) This is an unsymmetrical section, and while the geometrical center of the channels is the line C-C, the center of gravity is the line CG-CG, 2.45 inches above C-C. The buffing strain is along the center line of the coupler, which is 2 feet 10½ inches from the top of the rail, and this strain comes on the center sill below the center of gravity CG-CG or at CB-CB, 3½ inches below. In other words, there is an eccentricity of about 3.5 inches that tends to bend the center sill in a curve or to produce a tension in the top flange. And in the case of the car empty and a buffing strain of 300,000 pounds, neglecting the dead weight of the car, there is a tension of 507 pounds, theoretically, at the center. Taking the dead weight of the car into consideration would just about equalize the strains. Taking the car loaded, this eccentricity amounting to as much as shown, reduces the strains in the center sill very materially and makes a very much better case than to have added a heavy plate at the bottom of these channels, as that would have lowered the center of gravity and reduced this eccentricity so that this negative strain would have been much less and you would have had less to deduct from the bending moment due to the vertical load. The stresses due to combined vertical load and buffing (direct thrust and from moment) in the center sills of the Philadelphia & Reading car are:

Top flange, 9,223 lbs., including 25 per cent. impact.

Bottom flange, 12,258 lbs., including 25 per cent. impact.

It will, therefore, be seen at once that Mr. Summers has only figured the direct thrust due to buffing, but has overlooked the more important strains due to the eccentricity of the center sill.

With the Philadelphia & Reading car loaded the buffing strains reduce the strains due to vertical load; therefore, the large faced type in Mr. Summers' paper condemning the center sills of this car is wholly uncalled for. The center sill is all right.

In the case of deflection I do not see that Mr. Summers has made any allowance for deflection of the body bolsters. These are apt to deflect a little, and if they do, naturally they lower the side sills, and that of course eases up on the floor beam connections. Also, no account is taken of the negative deflection of the center sills, due to the load between the body bolsters and the ends of the car. This reduces the actual deflection of the center sill and the deflection of the body bolsters increase the deflection of the side girders, so that Mr. Summers' figures need changing. Any way, this question of deflection is given undue importance, in view of the above. Of course, Mr. Summers says that these cars are merely to represent types, but as he has taken the exact dimensions and figured exact strains, I think it only fair to have it implied in the paper that the manufacturer has worked on wrong lines.

I notice in Mr. Summers' car that he does not show any doors. I suppose that this may be an error or rather an omission in the drawing. If doors are added, of course, there are door frames, doors, chains, winding shafts, pawls and other things to increase the weight of the car. I also notice in his car that he has not any end sills. To be sure that does not add anything to the capacity of the car, but it does to the weight. The Philadelphia & Reading car has doors, as well as a 9-inch end sill. Therefore, the comparison of the dead weight of the cars is hardly fair unless you add the weight of these items to the Summers car and then the ratio of paying load of coal to total weight needs changing, and the percentage then will be nothing remarkable. The weight of Mr. Summers' car seems misleading.

I would like to have Mr. Summers enlighten us later what he proposed to do in case he desires to adapt his car to a twin hopper bottom gondola. They seem to be a very popular type and very useful as a general utility car. He would have to have two flanged sections between his hoppers in order to hold his hopper plates, and to provide protection for his chains, carrier pulley, winding drum and shaft. These flange sections would have to be supported at their ends by one of the cross-floor beams, and as the load would be very great, the 9-inch I-beams would not be strong enough, and it would save much weight to lengthen these flange sections a few feet and connect them with the body bolsters. You then have a center sill. Therefore, the condition of this type of car cannot be met without a center sill.

The splice through the center of the Summers car I think is rather an unnecessary thing, except for ease in handling the plates, in forming the top flange. I do not believe the top flange good practice from any standpoint. I think that service will eventually show that while theoretically correct, in case of its being damaged in a wreck it cannot be repaired except at great cost to the shop where it was built. The Pressed Steel Car Company in its early days formed the top flange of the sides of its cars by flanging the side sheets. I notice now that they put on an angle, which can be straightened if it becomes bent in punching, while repairs can be very easily made in case of any damage to the top flange caused by a wreck.

The shop cost of Mr. Summers car, as estimated, would be very excessive as compared to the costs of the other cars, and it could not compete with them. I also notice that the stakes are on the inside of the car. This permits a wider stake without extending the width of the car, but it cuts down the capacity of the car for lumber or loads of that kind and makes projections which are bad in shoveling coal out of the car.

It is interesting to notice that the floor of the Summers car is of uniform strength, with the exception of two light cross beams from the body bolsters. The 9-inch I-beams are sufficient for 21,000 pounds, with a fibre strain of 16,000 pounds or a concentrated load of about 10,500 pounds or 5.25 tons. So that if 5.25 tons were put on the center of one of these beams it would have its maximum load. And such will be the case if the car has to carry billets or similar heavy concentrated loads. The floor is not able to transmit the full strength of the girders in case of concentrated loads.

Mr. Summers speaks of the floor being able to transmit buffing strains. The thickness of the floor plate is ¼ inch, and the width of the shortest panel 3 feet 4 inches, or 40 inches. The ratio, therefore, is ¼ to 40 or 1 to 160. Any structural engineer knows that, roughly speaking, 1 to 40 is the limit. Of course the plate is fastened by rivets on all four edges to the car, and it is therefore a little better case, but still a weak proposition. But it is hardly good practice, I think, to expect a ¼ inch plate of that size to transmit very much strain without danger of buckling.

Another objection to the Summers car, I think, is the wide and long bays unsupported between the 9-inch I-beams. It looks as though they ought to have the support of good, healthy center sills. The Philadelphia & Reading car was evidently taken off of an old print. The section shown is not the actual drawing on which the cars were built. The space between the center sill channels is 10 inches instead of 8, and the top plate is quite a little wider than is shown here in the paper. This increases the section modulus slightly.

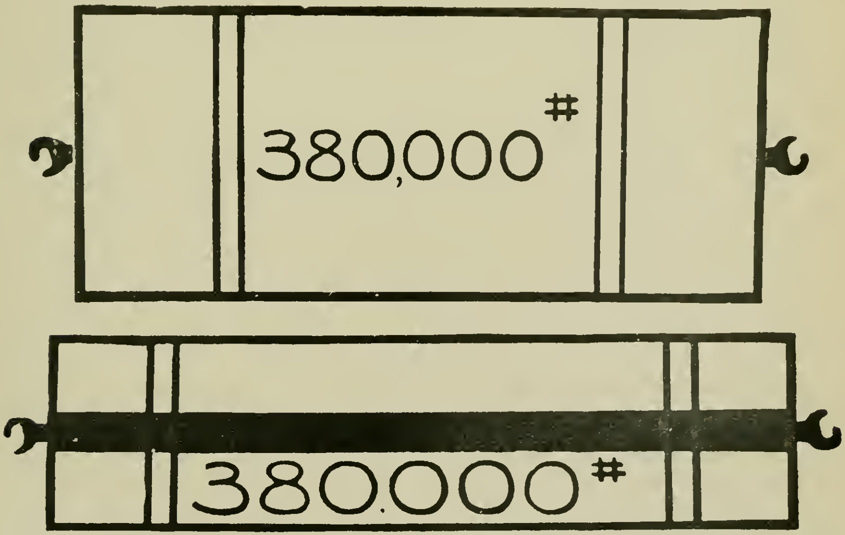
There is one point which Mr. Summers appears to have overlooked in connection with buffing strains in his car. He evidently has not figured the strains from buffing when his car is empty. The center of gravity of the side girders is 26.4 inches above the center line of the buffing strains, that is, an eccentricity of 26.4 inches. This produces a heavy strain. Taking the buffing on the side girder as 150,000 pounds, we get a strain of 22,210 pounds in compression in the lower flange of the side girder. A better case, of course, is where the car is loaded, because then there is a tension to offset this compression, due to the vertical load in the car. Now, this supposition is made that the buffing strain is exactly divided, 150,000 pounds on each side. I doubt very much whether a car could be constructed so accurately that you would not get more than 150,000 on one side. It is plain that the buffing strain coming below has to be transmitted up through the center of gravity. This is a point which structural engineers never overlook.

Take the case of a bridge member shaped of two channels with a plate across the top and latticed on the bottom with the center of gravity some two inches above the center of the channels. Members like this have been tested at the Keystone Bridge Company. Two members built just alike, one with a pin in the center of the section and one with a pin in the center of gravity, gave vastly different results. One showed 26,000 and some odd hundred pounds when the pin was in the center of gravity, but when the pin was in the center of the section some two inches below the center of gravity it only gave 17,000 pounds. This shows the necessity of putting the pin in the center of gravity. Now we have the reverse here due to the effect of the vertical load. The center of gravity helps you out when your buffing strains come below it, as in the Philadelphia & Reading car.

Now, in the case of the fish-bellied sill of the Pennsylvania car, the center of gravity comes approximately four inches below the buffing strain. That tends to increase the tension on the bottom flange of the sill, and to give high strains. In other words, it is a negative bending moment in the Philadelphia & Reading car, while in the Pennsylvania car it is positive moment, giving strains to be added to the direct thrust and to the strains from the vertical load. This point to date seems to have been overlooked by most car designers. It is my private opinion that the Summers car will have a tendency to buckle the floor and spread the sides if it is loaded with 25 tons of ore over each bolster, with no load at center of the car and should get a good sized "bump."

President: We are very fortunate in having with us Mr. L. A. Shepard, mechanical engineer from New York, and I hope Mr. Shepard will find it convenient to make us a few remarks.

Mr. L. A. Shepard: Please note carefully the two diagrams representing the underframe of cars, one without a continuous draft, the other with continuous draft. With a strain of 380,000 pounds on draft rigging you can draw your own conclusions as to which is the proper construction.



Figs. 9 and 10.

What do we require for a practical car to haul the heavy loads of this day, and resist the excessive buffing and pulling strains. Principally a continuous draft. The center sills alone provide this, and around them we build the car. In the diagram, Fig. 11, there are two center sills made of commercial

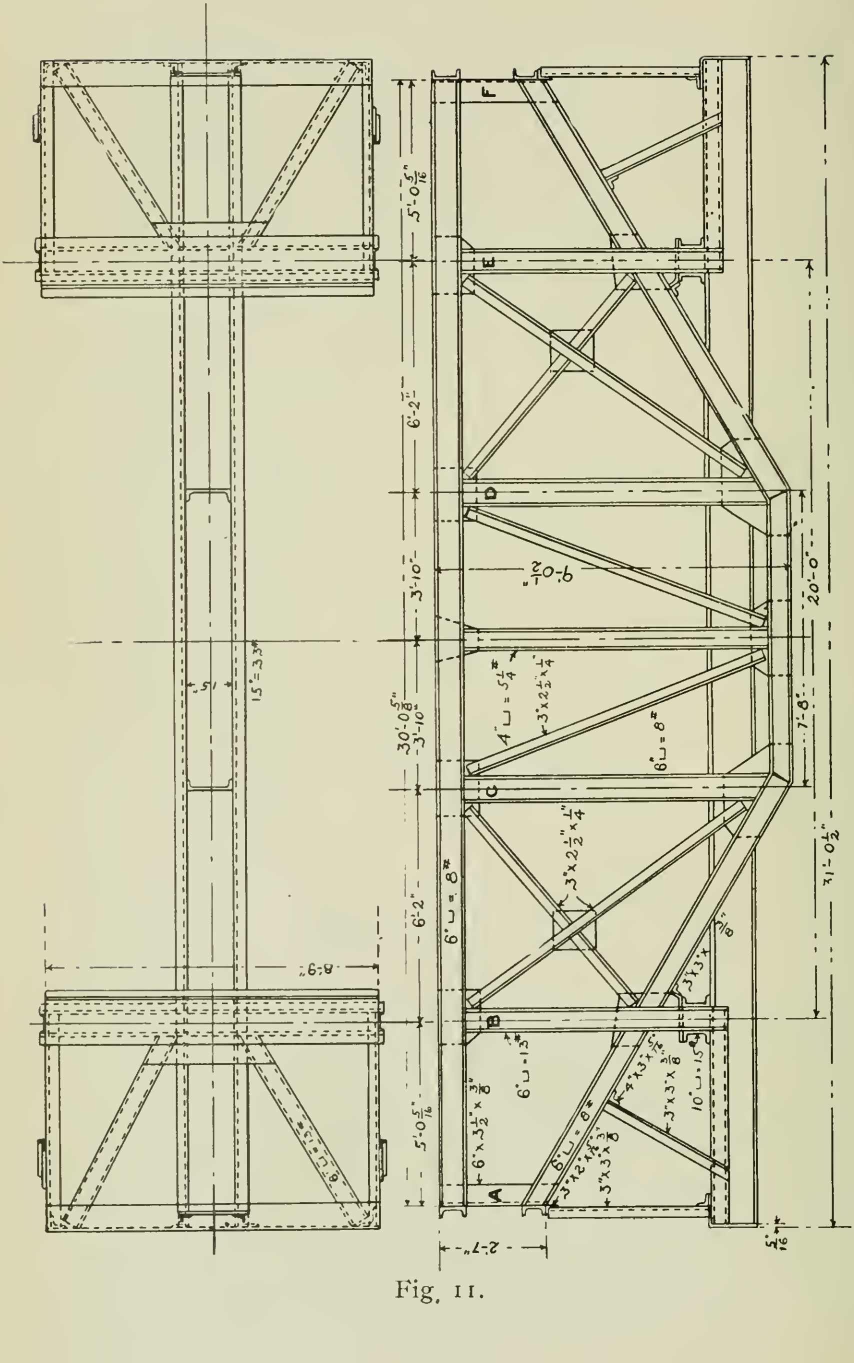

F
E
D
C
B
A
5'-0 5/16"
6'-2"
3'-10"
30'-0 5/8"
3'-10"
6'-2"
5'-0 5/16"
9'-0 1/2"
20'-0"
7'-8"
41'-0 1/2"
5/16
2'-7"
8'-9"
15"
15" ⊔ = 33#
4" ⊔ = 5 1/4#
3"x2 1/2"x1/4"
6" ⊔ = 8#
3"x2 1/2"x1/4"
6" ⊔ = 8#
3"x3"x 3/8"
6" ⊔ 13#
6"x3 1/2"x 3/8"
4"x3"x 1/2"
3"x3"x 3/8"
10" ⊔ 15#
6" ⊔ = 8#
3"x2"x 1/4"
3"x3"x 3/8"
8" ⊔ 15#

Fig. 11.

structural steel channels, and it is obvious to all that structural steel is employed in the car throughout. Although 400 out of the first order of 1,000 cars built by the Schoen Pressed Steel Car Company were constructed of structural steel, until recently the structural steel car has been dormant. But now it is evident that the car built of structural steel is the coming car, and the car that will be most extensively used in the future. I need only cite the conclusions reached by the road which has purchased the largest number of steel cars since the inception of the industry in this country. The limit of the pressed steel shape for sills for long spans, or concentrated loads, has been reached, and we see them reinforcing the bottom flange of the sills with angles and the top flanges with cover plates. And in this connection I would like to quote an authority, Mr. W. H. Marshall, of the L. S. & M. S. Ry. Co., who says in regard to some tests made to determine strains on draft gear:

"There is one fact standing out prominently in the results of the tests, which is that the most ordinary movement in coupling up engines and cars, even if performed with care, results in heavy buffing shocks. An engine coupling on to its train gives stresses ranging from 65,000 to over 142,000 pounds; a switch engine coupling onto the dynamometer car standing alone gives a stress of 103,673 pounds; when a string of loads was behind the car a switch engine coupling on gave a shock of 199,482 pounds; and thirty loaded cars moving at about six and one-half miles per hour and coupling onto ten loads, with brakes set, gave a shock of 376,492 pounds. Upon arrival at West Seneca, after the completion of a certain trip, the train was placed on the receiving track in the poling yard, and the dynamometer car being on the head end, the first operation was to pole it onto a track that was supposed to be clear. There was, however, a loaded 60,000-pound furniture car standing on the track, and the dynamometer car struck it at a speed of thirteen and one-half miles an hour. The apparatus in the car recorded 381,704 pounds, which was its limit. What the actual shock was cannot be told. A coupler was broken and some slight additional damage was done. The car was new, which doubtless explains the small damage done.

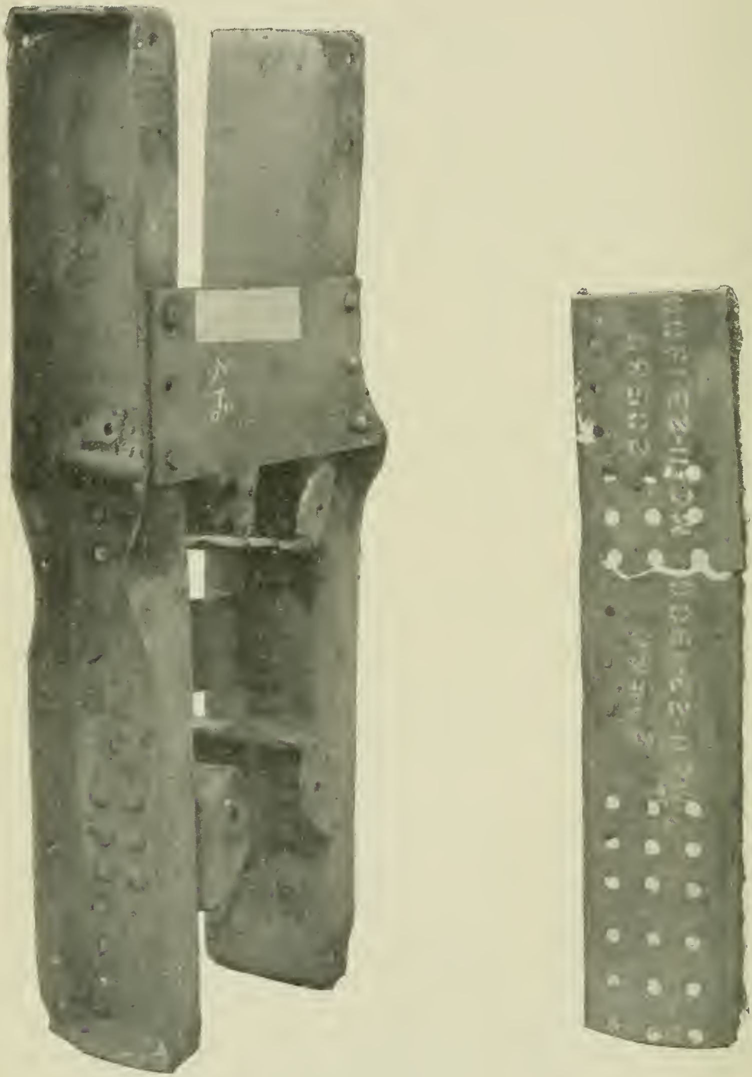


Figure 12.

From the general results of the tests it is believed that the tensile strains in draft gears with careful handling will frequently reach 50,000 pounds, with ordinary handling 80,000 pounds, and with decidedly rough handling fully 100,000 pounds, while the buffing strains can be placed at 100,000, 150,-

000 and from 200,000 to 300,000 pounds, respectively. In extreme cases the buffing strains will go considerably above the last-named figure. It will undoubtedly require more extensive tests to determine whether these figures need modification, but it is evident that the tests give us a more definite idea of the strains which draft gears and sills must stand than we have been able to obtain heretofore.

We think the figures show the necessity of something better and more effective than the spring draft gear so commonly used. It would be reasonable, in view of the above figures, to require draft gears and underframes to be capable of withstanding tensile strains of 150,000 pounds, and buffing strains of 500,000 pounds, and it is evident that the present spring resistance is inadequate. Whatever one may think of the details of the various friction draft gears, it must be evident that in the character and amount of resistance they are superior to the spring gears."

(Western Ry. Club, May 20, 1902.)

Next we require some means of transferring the load of the car to the trucks, and for this purpose we construct body bolsters. You will note that this bolster is made up of channels and plates surrounding the center sills, and each bolster is capable of carrying one-half the total load at its ends. We now require a body in which the load can be confined. We have a deep plate which has sufficient strength in itself to carry the load on account of its depth, and only require angles and flanges to provide lateral stiffness against buckling. Hence we do not require side sills, in fact they are superfluous. The bridge-like structure is well able to care for all endwise shocks on the body. It is supported from the ends of the body bolster through a channel strut. Again in order to provide lateral stiffness a top cover plate is riveted to the bolster channels and to the floor support angle. In this way the bolster is given a very large factor of safety—commensurate with its importance as a vital portion of the car. The sides are built in sections in order to facilitate repairs. A to *B* is one section, B to C another, C to D-D to E-E to F, etc. The top chord alone being continuous.

TABLE OF WEIGHTS AND CAPACITY OF CARS.

Owner.	Type.	Length Inside.	Width Inside.	Heighth Top of Rail to Top of Sides.	Capacity Cu. ft. Level Full.	Capac. Cu. ft. Heaped 30°.	Capactity lbs. Coal 52 lbs. Cu. ft. Level Full.	Capacity lbs. Coal 52 lbs. Cu. ft. 30° Heap.	Light Weight.	Ratio Paying Load to Total Weight.	Load Limit
B. & O. R. R.....	Pressed Steel.	30 ft., 0¼ in.	8 ft., 8½ in.	10 ft., 7½ in.	1,590	1,886	82,680 lbs.	98 072 lbs.	36,700 lbs.	72.7 per cent.	110,000 lbs.
W. Va., C. & Pg. Ry................	Vanderbilt Structural Steel.	30 ft., 0⅛ in.	8 ft., 8½ in.	10 ft., 7½ in.	1,594	1,889	82,888 lbs.	98,228 lbs.	36,600 lbs.	72.9 per cent. Loaded with ore to limit=76.6 per cent.	120,000 lbs.
North'n Pac.....	Gillette Herzog Composite	29 ft., 0¼ in.	8 ft., 8½ in.	10 ft., 4¼ in.	1,557	1,842	80,960 lbs.	95,780 lbs.	37,400 lbs.	71.9 per cent.	100,000 lbs.
L. S. & M. S......	Pressed Steel.	30 ft., 0¼ in.	9 ft., 6 in.	10 ft., 0 in.	1,680	2,030	87,360 lbs	105,560 lbs.	36,600 lbs.	74.2 per cent.	110,000 lbs.
Erie..................	Pressed Steel.	30 ft., 0¼ in.	9 ft., 6 in.	10 ft , 0 in.	1,680	2,030	87,360 lbs.	105,560 lbs.	36,300 lbs.	74.4 per cent.	110,000 lbs.
N. & W...........	N & W. Composite.	30 ft., 9 in.	8ft., 8 9-16 in.	9 ft , 6⅜ in.	1,608	2,038	83,610 lbs.	105,980 lbs.	39,500 lbs.	72.8 per cent.	110,000 lbs.
P. R. R............	Pressed Steel.	31 ft., 6⅛ in.	9 ft., 6 in.	10 ft., 0 in.	1,685	2,056	87,620 lbs.	106,912 lbs.	39,600 lbs.	72.9 per cent.	110,000 lbs.
L. V. R. R........	Pressed Steel.	30 ft,, 0¼ in.	9 ft., 6 in.	10 ft., 2½ in.	1,738	2,088	90,376 lbs.	108,576 lbs.	37,600 lbs.	74 2 per cent.	110,000 lbs.
Lack., C. & C. Co................	Vanderbilt Structural Steel.	30 ft., 0 in.	9 ft., 0 in.	11 ft., 3 in.	1,822	2,136	94,744 lbs.	111,072 lbs.	37,800 lbs.	74.6 per cent. Loaded with ore to limit=76 per cent.	120,000 lbs.
L. S. & M. S......	A. C. & Fdy. Co. Structural Steel.	32 ft., 0 in.	9 ft., 0 in.	11 ft., 7⅝ in,	1,800	2,140	93,600 lbs.	111,280 lbs.	38,300 lbs.	74.3 per cent.	110,000 lbs.
C. R. R. of N.J.	Pressed Steel.	30 ft., 0¼ in.	9 ft., 6 in.	9 ft., 10 in.	1,569	1,864	81,588 lbs.	96,920 lbs.	34,700 lbs.	73.6 per cent.	88,000 lbs.
C. R. R. of N. J.	Wood High Side Hop. Gondola.	32 ft,, 0 in,	8 ft., 5¼ in.	9 ft., 0 in.	1,391	1,676	72,330 lbs.	87,152 lbs.	36,000 lbs.	70.7 per cent.	88 000 lbs.

The short side brace from end sill to body bolster will appeal to you, when you realize that you have but a short channel to straighten in case of injury in a wreck, instead of a long side sill and injury to the sides of the car. With this side brace and the diagonal brace shown, the corner of the car is well protected. The ends of the car are connected to the end sill by angles.

Gentlemen, I thank you for your kind attention.

President: Mr. A. Stucki, formerly mechanical engineer of the Pressed Steel Car Company, is here this evening, and we should like to hear from him upon this subject.

Mr. A. Stucki: Gentlemen: I hardly think there is very much for me to say after you have heard Mr. Summers, Mr. Bellows and Mr. Shepard. However, several points have not been touched yet, and a few remarks on same may be of interest. In a general way I agree with Mr. Summers in his remarks on steel cars, but I do not agree with him as to the relative strength of the cars and the methods of getting at strains and stresses. Neither can I, like the other two gentlemen, take his point of view on the main issue to-night, i. e., leaving off the center sills.

I am not very familiar with the P. & R. car; but I am quite familiar with the G. S. car, for the Pressed Steel Car Company built it while I was with them. Following Mr. Bellows' suggestions, I would say that, since 100,000-pound cars are subject to a load of 110,000 pounds, we certainly should take this load into consideration whenever calculating stresses; and, as I have never seen a load of 100,000 pounds uniformly distributed between bolsters, we should figure on a uniformly distributed load from end to end and adapt a factor of safety accordingly. By this means we will be able to take care of the effect, due to different length of overhang.

Right here, gentlemen, I may say, that it would be a great assistance to the car builders if the railroads would adopt more uniform conditions, for which the cars have to be built. I have mostly reference to flat cars and gondola cars, as we know pretty well how the other kinds of cars are loaded. This would enable the manufacturer to build a car at a minimum cost and still amply strong enough for the purpose. Railroad companies would get the benefit of this reduction in cost. Besides this they would not need to haul so much dead weight around the country.

I will not say anything about the P. & R. car, as Mr. Bellows has covered the ground very thoroughly, and more in detail than what I would have been able to do. As to the G. S. car I may simply add that I have found the stresses to run quite a little below those mentioned in the advance copy. However, one item, and a very important one, has been left out of the comparison. I mean the floor; and it is very material to know what this floor has to do in the G. S. and what it has to do in the Summers car. It is self-evident, as the author states in his paper, that the floor can be considered as a beam with a web formed of the ¼-inch floor plate. But the horizontal forces not being transmitted through the center of the car beyond 108 inches from the end sill, the depth of the girder is naturally limited by this figure, and the length of the girder is equal to the width of the car. If we figure the strain on such a girder, we will have to take the buckling into consideration, just as Mr. Bellows has said before. We will also find that a girder with a plate unsupported for 54 inches, as is the case in the Summers car, the maximum shearing stress in that web dare not exceed 700 pounds; and multiplying this 700 pounds by the total area of the web, which is 29 square inches, will give you a force of 20,300 pounds per side, or 40,600 in all per car as the total end shock which the car can safely take without danger of buckling the web.

In the G. S. car you will find conditions much different. Just back of the end sills the draft sills and the floor for a width of about 33 inches form a solid column, which takes the whole end shock. Then a small part of this shock is transmitted to the side sill by the floor; but, since the maximum shearing strain for a plate girder with a web unsupported for 34 inches is not to exceed 1,200 pounds per square inch, in order to be safe against buckling, this part transmitted is very small. In the second panel, directly back of the body bolster, we have that much less of an end shock on the center sill and another small portion is again transmitted from the center to the side sill; and continuing this way, panel after panel, we finally get a uniform stress in the side sills as well as in the center sill without buckling the floor. This is the main difference between the two cars, and goes to show that a center sill is very essential. It forms a back bone to the car, and if that back bone is gone the strength is partly gone, too.

A friend of mine this evening, who is not a mechanical engineer, just mentioned to me that this car reminded him somewhat of a house without foundation. "Of course," he said, "this comparison is rather forced, but I think it indicates the opinion of many railroad men." I have mentioned here very severe figures, but you will agree with me that they are corroborated by actual every-day experience. Let us stand on the bridge of a large classification yard and watch the bumps and shocks and strains these cars will have to undergo, and I think you will agree with me that a ¼-inch sheet unsupported and beside that already taxed to a maximum by the load, can not take that punishment. Again, if you visit the repair shops and watch the cars coming in with bumped-in end sills, buckled draft sills and distorted diagonals, I think this will substantiate what I said a moment ago.

As to the weight I agree fully with Mr. Bellows. It is true Mr. Summers has left off the center sill between the body bolsters, which means an average cross sectional area of about 11 square inches. That is what it amounts to in the G. S. car. In the sides we have an effective cross section area of about eight square inches, which makes a total of 38 square inches per car. In the author's car we have apparently 27.5 inches of effective material, judging from his figure, 10,900, as compressive stress in the side girders when resisting 300,000 pounds of end shocks. That means that the G. S. car has an excess of 10.5 square inches for a length of 30 feet, which makes, if you figure it out, approximately, 1,000 pounds. But there is a big question in my mind whether this weight is really saved. The load will now have to be carried from the center of the car to the sides, necessitating heavier floor supports. Mr. Summers uses 9-inch I-beams. The G. S. car uses only light channels, about 7 inches deep, made of ¼-inch material; and I fully agree with Mr. Bellows that, in some cases, even these I beams would not be strong enough. Then the load has to be transmitted back from the sides through the body bolster to the center plate, which means that the body bolster has to be very much stronger on the Summers car than on the G. S. car; and it is questionable whether there is any saving in this respect. There are 5,000 pounds mentioned as being saved in the Summers car in all; but, as I do not know of a single detail in the G. S. car that could be lightened up without decreasing the strength also, I am inclined to think that lightness has been attained by decreasing the strength proportionately.

A great disadvantage exists in the Summers car on account of the large and unsupported floor panels. The largest one, I think, is on the corner, amounting to 46 by 54 inches, which, with a maximum load on it, will mean a fiber stress of 21,000 pounds, figuring the floor as being rigidly held all around its edges. In the G. S. car we have altogether smaller panels, being about 46 by 36 inches, corresponding with a fiber stress of 14,320 pounds per square inch. In the Summers car, as mentioned before, the panels between the body bolsters extend from side to side of the car, with an unsupported floor area of 115 by 34 inches, which means a fiber strain of 19,500 pounds per square inch under maximum load, while if center sills had been used these panels would have been shortened and the fiber stresses per square inch reduced to 14,000 pounds. Quite an item.

We dare not forget that, by the use of a center sill, a portion of the floor, a strip about 33 inches wide, is stiffened by the center sills, thereby forming a solid column, able to take straight compression. In the design of Mr. Summers this material has been lost completely in this respect and, as mentioned by Mr. Bellows, the floor would sag and would not be able to take any of this end shock.

The percentage of paying load is stated as 70.2 against 74.7 in favor of the Summers car. I do not think the comparison is a fair one, because about 91,000 pounds of load have been taken into consideration for the G. S. car, while it is able to carry 100,000 pounds and more; and therefore, in order to get at a fair comparison, I think the same load, as well as the same cubical volume, should be used in all cases. By the way, I may also state that the Pressed Steel Car Co. has built a great many cars of a similar type, with the same cubical capacity as the Summers car, and with a weight low enough to bring the percentage of paying load up to 74.6 per cent. I figured out one particular case, and I know that several other designs of that company are equally as economical. All those cars have center sills.

The Summers car, as a whole, undoubtedly is all right if the end shocks are not excessive, as explained above; if the floors are kept straight, if the sides are not bulged at the top or crushed in at the bottom, and if everything is straight and in line, as we expect it to be. But as soon as one of these conditions ceases to exist I doubt very much whether the car would stand the racket. On the contrary, take the G. S. car and have one of these items to fail, and I am sure the car is safe enough to take the load home without any serious consequences.

I notice that the top of the sides of the Summers car are turned over by means of a special and, I am told, ingenious machine. This top, part of the way, is also reinforced by means of a flat plate riveted to the side sheet. This again reminds me of Mr. Bellows' suggestion to use rolled shapes in place of this construction. Exactly the same results could be obtained by using angles, one extending the whole length of the car and the other one only part of the way; and I am sure the first cost of the car would not be increased by this construction; and I am also sure it will facilitate the repairing very greatly, which certainly will be appreciated by the railroad companies.

With your kind permission I will read off a part of the table printed in the paper, but I will give the stresses which I have put down in ink after going over the car and over the stresses quite carefully. I will leave out the P. & R. car, but will add figures pertaining to the floor.

...	Penn'a R. R. G. S. Car.	E. W. Summers Car.
Stress in side girder from 110,000 lb. load, plus the whole weight of car body with 50 per cent. impact	11,000 lbs.	7,200 lbs.

Extreme compressive fiber stress per sq. in, in side girders, when resisting the intended buffing load of 300,000 lbs. per car.....	6,060 lbs.	10,900 lbs.
Resultant stress per square inch in side girders from buffing and vertical loads combined	4,940 lbs.	3,700 lbs.
Stress in floor due to load.......	14,320 lbs.	21,070 lbs.
End shock car is able to take without danger of buckling floor	300,000 lbs.	40,600 lbs.

President: Gentlemen, to get information on a good piece of work it is a good plan always to go to a man who is directly responsible for it. I believe that Mr. Charles A. Lindstrom, chief engineer of the Pressed Steel Car Company, can give us some very valuable information on steel car construction.

Mr. Chas. A. Lindstrom: I have read Mr. Summers' very valuable contribution on the subject of "Steel Cars Without Center Sills" with a great deal of interest, and hope that as a beginning has now been made, in bringing before the railroad world such an important matter as the proper construction of steel freight cars, this paper will soon be followed by other equally as important contributions, for it is only through such papers and a free discussion of them that the real facts and requirements can become known. I regret exceedingly, however, that my spare time, since the advance copy was received, has been very limited and that it has been impossible to devote sufficient time to the matter in order to go into the figures presented in detail, and that my remarks must be confined to a general review of the subject. It is possibly unecessary to call attention to the fact that cars designed without center sills is not a new feature, for all railroad men probably know that thousands of such cars are and have been in every day service for many years, but the idea that such a construction has decided advantages over the use of the center sill construction seems new on the face of it. At least if it has been advocated in the past, it could not have been pushed vigorously enough to come to the front. In the past it has generally been thought that when peculiar or special conditions, such as the transportation of large castings, in the shape of fly wheels, generator fields, armatures, large plate glass, etc., which by their size, would exceed the road clearances, if loaded on ordinary cars, or when the use of large and unobstructed drop doors, demanded the doing away with the center sills, it was an unavoidable disadvantage instead of a blessing in disguise, and which had to be compensated for in the use of increased size of bolsters, intermediate stringers or flying transoms. It cannot, however, be denied that at least some of the cars designed in the past without center sills, at any rate, those which were carefully calculated, have proven satisfactory, and I particularly call to mind a design for 100,000 pounds all-steel flat cars prepared in 1886 or 1887 at Altoona, during my connection with the Pennsylvania railroad. This design (from which four cars were built were prepared for the transportation of large reels containing street car cables from the Roebling works at Trenton), consisted in the use of heavy riveted upside girders of the fish belly type and had the floor supported on "I" beams in a similar manner to what is now proposed.

These cars, I believe, are still in service and utilized for the carrying of heavy machinery, armor plates, guns, etc., and have never, to my knowledge, required any extensive repairs due to weakness of construction.

Another type of car without center sills, to which I may refer, is the 100,000 pounds ore cars built by the Pressed Steel Car Company for the D. & I. R. railroad, D., M. & N. R. R., Great Northern R. R., and for some other roads. This style of car requires large door openings to facilitate unloading, in which construction center sills cannot be used. The above two types with several others are, however, exceptions and not the rule.

The use of center sills seems to me most rational, as they are located as near as any detail can be, in the most direct line of the severest forces and form, by the help of the couplers, an unbroken straight connection from the engine to the cabin car through all the cars in the train. They are the backbone of the whole structure against which the pulling and pushing forces may be exerted with the least danger of damage, and will require comparatively less material than any other construction, for it is self-evident that a straight column loaded on its ends will sustain a greater load than a crooked column or a beam supported at its ends and loaded in the middle.

Nature itself teaches us the use of a backbone, not only in various species of the animal kingdom, but in vegetable life. Imagine what would happen to a sword fish when it buries its weapon in the plank of a vessel, if nature had not provided it with a backbone to distribute the shock. The sword would be driven into the body of the fish and the body flattened against the side of the vessel. Another illustration might be given with which perhaps we are all more familiar, as it is frequently seen on our streets, and that is an Italian or perhaps a Hungarian woman, carrying a large and heavy burden on her head. If she was not provided with a backbone, immediately under her head, but instead had two bones, one on each side, like side sills on a car, the size of her collar bone would have to be of enormous proportion or her neck would be forced into her body. (Laughter.) Similar disastrous results frequently happen to cars constructed without center sills, except where they are reinforced in other respects, as explained before.

The author of the paper under discussion has, it seems to me, been quite unfortunate in his selection of the two types of cars used for comparison, as well as in the selection of the design brought out as a substitute, for there is very little to compare practically between the three designs. The P. & R. car is what may be termed a medium side gondola car, evidently intended for carrying coal or similar lading uniformly distributed. The proposed car has sides 6 inches higher which unquestionably would not be acceptable to the railroad company on account of local conditions. Therefore, the two cannot strictly be compared with each other. The criticism of the distribution of stresses in the various members of the P. & R. car is, however, well taken, but the defects are not due to the use of center sills, but to the light transoms or diaphragms, which have not sufficient depth at their inner ends to transfer the load to the sides and thereby relieve the center sills.

This is an error of the designer and has nothing to do with the principle of construction.

Referring to the Pennsylvania railroad "GS" car, it will be seen that its sides are also lower than the proposed car, which prevents a strict comparison between the two, and has something to do with the difference in weight. However, the balance of the difference in weight is not due to the use of center sills.

The Pennsylvania railroad has found, through long and carefully conducted investigations, that there is economy in making other details of the cars, besides those that actually carry the lading, of sufficient strength to stand the very rough usages to which freight cars are exposed, and such details are therefore made exceptionally heavy on their later classes of cars to which the "GS" cars belong. There are very few roads which consider this question of sufficient importance, and refuse to pay for what is sometimes called unnecessary finery and the P. R. R. cars therefore suffer in comparison of dead weight by those who may not be acquainted with the facts.

There is another very important point which must not be lost sight of. The stakes in the proposed car project inside of the sides and are made of a single plate, a construction which, of course, greatly reduces the weight, but which is not a desirable one from a railroad standpoint, and will not receive general approval. Stakes so located are constantly in the road when the car is unloaded by shoveling, and will not only be bent and broken when heavy pieces are thrown against them, but are likely to be reduced in a short time by corrosion, to a point at which they will not have sufficient strength to support the sides. They have, however, in this instance helped to serve a purpose, namely, to produce on paper a light constructed car.

There may be some defects in the distribution of the material in the "GS" car which a little carefulness may have avoided when the design was prepared, but the difference in deflections, amounting as stated, only to a combined sum of .132, a fraction above 3-16 inch, is too small for any serious attention.

It is not always practicable and sometimes undesirable or even impossible, for various reasons, to proportion the different members in freight cars so nicely that stresses and deflections in all of them will be the same, and it certainly is not necessary to the life of a car, for the twisting and wrenching which it receives in every day service through unevenness of track, use of push poles, etc., is far more destructive than any internal stresses and practically upsets all theories.

Theoretical calculations are all right, and modern steel cars are more or less based on some sort of computations, but these must be tempered with practical experience and a knowledge as to the particular service in which the car is to be used and the objects for which the different details are designed, not only as to the computable loads and shocks they must be able to stand, but also as to the uncomputable forces and destructive agencies which they are continuously exposed to and for which they must be proportioned.

While, therefore, I am open to convictions, I cannot see that the question of doing away with center sills and substituting a side construction has been presented to us in a clear enough form to warrant change of present practices.

President: If there is no one else present who wishes to say anything further on this subject, I will ask Mr. Summers to close the discussion.

Mr. E. W. Summers: Mr. President and Gentlemen—It would be difficult for anyone hearing the arguments of the gentlemen who have just gone before me to take up their questions in detail and answer them all the way through on such short notice. But I have made a few notes here from which I will make some remarks. Taking Mr. Bellows' remark to start with, he has considered a uniform load over the car from end to end, which, of course, will give a different result in the calculation of stresses. Now, I happened to be in one of the steel companies' yards here a few months ago, and I saw some B. & O. cars loaded with sculls (that is, steel which has been allowed to cool in a ladle in such shape that they cannot remelt it.) I understand that they take these sculls out in a field and break them up with dynamite.

They weigh each something like 60,000 or 70,000 pounds.

They were loaded in the car somewhere near the bolster, but toward the center of the car from the bolster. Such a load as that, concentrated at one point is not a distributed load. And we often find other loads, such as pig iron and billets, loaded through a car in such a way as to overload the central portion quite a good deal, so that I think it is hardly safe to build a car expecting it to get a uniform load, carrying only its capacity. We may often get concentrated loads of machinery distributed over a portion of the car that will be of the entire capacity of the car. I think that all cars should be designed so as to take such loads. I am of the opinion that the method of loading I have used in this comparison is a just requirement for cars, and since I have used the same load for all three types, the comparison is just, and it is hardly consistent for Mr. Bellows to say that his car was designed for a general purpose car, when answering my statements with regard to "ratio of paying load of coal to total weight" and then with regard to stresses, change the loading and call it a coal car. I notice in the discussion that only one of the speakers has taken up the main point in my argument, that is, with regard to the buffing stresses not being transmitted through the center sill from end to end, a condition brought about by the deflection caused by the vertical load. Mr. Lindstrom has said that these deflections are very slight, and taking such loads as cars are subject to (I may not quote him exactly), such slight deflections are too small to take into account. I would call your attention to the difference between steel and wood. In wooden cars one member may slip on the other on account of the bolts bedding into the wood and thus adjust the parts, allowing the members to act independently of each other. But in cars such as I have been considering here, slight movements of one member on the other are impossible. With steel center sills and steel sides and steel floors all rigidly attached together, the elongation of the bottom edge of the side girders (due to the vertical load) will put tension in the floor and center sills.

All of you undoubtedly know that a line stretched and held rigidly, without deflection, between two points with a vertical load on it somewhere in the center, will have tension in the member, the amount of which is infinite. Of course, we have deflection there and it is very difficult to calculate what the tension is, due to this vertical load. But I think you will all agree with me that the side girders deflecting, stretching the bottom and shortening the top, produces a tension in the floor plate tending to stretch it out and a portion of that is transmitted through to the center sills, and that the center sills are held comparatively rigid between the two ends with the vertical load deflecting them.

It is my opinion that with full sized tests it will be shown that the center sills are in tension at some point between their ends throughout their entire cross section. Under that condition this tension must be relieved before any horizontal buffing load can be transmitted through it. I believe that such buffing loads as the gentlemen before me were speaking of to-night will not relieve that tension on the center sills when under a vertical load such as used in this calculation. Now the proposal to have a load all distributed between the bolsters is one that we may get quite often, and the effect of that load I believe is near my figures for it, producing tension in the center sills and preventing them from transmitting a buffing load until that tension is relieved.

I am of the opinion that if the gentlemen will take it up on this line and calculate the deflection and the effect produced by the floor plates upon the center sills they will find that such slight deflections must be taken into account.

Mr. Bellows' argument about the location of the coupler with regard to the center of gravity in the center sills of his car and the effect of the vertical load counteracting the stress from the buffing blows, would all be very nice if the center sills were not rendered inoperative as a compression member by the action of the vertical load on the side girders. Mr. Bellows has also referred to having no doors in the car shown in my sketch in the paper. It was not a mistake in the drawing to leave out the doors. I will agree with Mr. Bellows that it is an unfair comparison with his car having doors. At the same time the doors in that car are not very heavy and the trucks from inspection, I would judge, are considerably lighter than the P. R. R. standard truck for a 100,000 pound car, which is under the cars that I have built and the cars that I have shown in this design. And the difference of weight in the truck may be a great deal more than the addition of doors to the car.

With regard to the twin hopper gondola, which Mr. Bellows says is a very popular type of car, I will say that I thought perhaps he was going to take up the question of having a portion of the floor left out which would then not transmit the buffing stress.

I have purposely in my calculations considered only 12 feet of floor plate at either end of the car because of these door openings that may be in the floor, and the fact that the vertical load producing the deflection of the side girders and the center sills and this placing of the center sills in tension would be the same whether the floor was all there or not, since the deflection of the side girders pulls outward the ends of the floor, and it would pull it out more by having a portion of the floor plate taken away, producing a greater tension in the center sills.

With regard to the construction of the drop doors requiring shafts across (winding chains, etc.) I do not know that we have to follow that method. I think that there may be other designs equally as good that will not require an unnecessary member (as I call the center sill), just for the purpose of furnishing a support for a winding shaft.

With regard to the end sills, of which Mr. Bellows speaks, which do not appear in the design shown in the paper and in some cars that I have built, I do not know that it is a necessary member.

End sills, built by The Pressed Steel Car Co. and some other companies, are made of a plate which is in box form, and the side of the plate is presented toward buffing blows that may come if the cars strike elsewhere than on the couplers. And from cars that I have seen struck on these end sills they do not offer any greater resistance than if it had struck on the end plate of the car.

Just let the end plate continue down and have the floor plate come in contact with the end plate as a stiffening member to take such shocks as the end sill is meant to take.

It appears to me that there are others that are coming to the same conclusion from the fact that in some applications for patents I have had pending there has been eight or ten interferences on that very construction, and parties in this room who are on the opposite side evidently think it a good thing to have a patent on anyway. (Applause.) With regard to the splices in the side plate shown extending through from end to end, it is so arranged on account of manufacturing the car to simplify the construction. This "questionable top" on the car put on by "a very ingenious machine," was put there for the purpose of increasing the rigidity of the top of the car side as a compression member. It is my opinion that cars are not made strong enough in that part of their construction. I have noticed a great many cars with their sides bagging out, sometimes two or three inches. I saw some new cars to-day as we came along, with loads of coal on, wooden cars, however, with steel underframe. I should think that they had their first loads on, and from a moving train we could see that the sides were bulged out. This, however, is not all due to the top of the side plate; it is due in this case, I think, to the combined lack of lateral stiffness and to the stakes not having a rigid enough connection with the cross beams. The detail shown for the top of my car sides has been tested on the cars that I built which have been in use since June of 1902, and there are no signs whatever of side deflection, or vertical deflection either.

The cars have been in use on the Pennsylvania Railroad most of the time between Ashtabula Harbor and The Ohio Works of The National Steel Co. in the ore trade. For a time they were off somewhere in this part of the country. One of them was for about three months on The Union Railroad handling material between the mills of The Carnegie Steel Co., a most severe service. The car after this use shows no defects other than in two or three places where the plates were slightly bulged by the heat from red-hot billets.

Mr. Bellows must be joking in some of his statements. He certainly does not think that 5.25 tons of billets thrown haphazard into a car can be so disposed as to form a concentrated load on the center of one of the floor beams of my car. His statements to this effect must be taken for what they are worth. He has also made statements in effect that structural engineers have learned to consider the action of eccentric loads on a column, and that I have overlooked this in considering the buffing blows as applied below the center of gravity of the side girders of my car. You will observe on page 10 of my paper that I give as the result on the car sides of a buffing blow of 300,000 lbs., a maximum compression in the lower flange of 10,900 lbs. per square inch, and this is counteracted by a tensile stress of 740 lbs. per square inch, due to the dead weight of the car body, leaving a resultant stress of 10,160 lbs. per square inch with the car empty.

The eccentricity is considered in the formula:

$$f_1 = \frac{M_2\ y_1}{I = \frac{P\ 1^2}{10E}}$$

In which

y_1 = 27 in. = distance c. g. from bottom of girder.
P = 150,000 lbs. = eccentric load on one girder.
M_2 = 150,000 lbs.x26 in. = 3,900,000 in. lb.
1 = 336 = length of column in inches.
E = 29,000,000.
I = 9,740.
f_1 = unit stress in extreme fiber.

Eccentric load applied 26 in. below the center of gravity.

$$f_1 = \frac{3{,}900{,}000 \text{x} 27}{9{,}740 - \frac{150{,}000 \text{x} 336^2}{290{,}000{,}000}} = 10{,}900 \text{ lbs.}$$

One of the gentlemen here brought up the subject of buffing loads that cars are subject to from shifting. You will remember that it was stated that cars are subject to buffing forces as great as 300,000 lbs., and Mr. Shepard quoting Mr. Marshall of The Lake Shore Railroad, speaks of coupling shocks as high as 376,000 lbs. just in shifting. I understand that on the Union Railroad they have some very heavy locomotives, and you will remember in the discussion of a recent paper on friction draft gear it was stated by an official of that road that ordinary draft rigging would not stand the blows of their heavy engines. Mr. Stucki has (after much calculation) determined that my car would possibly stand a blow of 40,000 lbs. Perhaps if he had known of the existence of such cars, and the extent and character of the service they have been in, he would have been more careful in his statements.

I do not doubt Mr. Stucki's ability as an engineer, and if he will just stick to the text and calculate the stresses in the two cars with the same loading, as I have done, he will obtain the same results which show clearly that with 5,000 lbs. less material in the car, I handle the same loads with lower fibre stress or a greater factor of safety. His remarks concerning the value of an unsupported plate in shear are interesting in view of the 40,000 lbs. result he obtains. I cannot agree with him as to what constitutes an unsupported plate. The first floor panel in my car with the draft sill. and the second panel, with the 6-inch pressed channel, throws 9 feet in length of plate into action to resist the buffing blows. This 9 feet by ¼ inch of plate has a section of 27 square inches which, divided into 150,000 lbs, equals 5,555 lbs. per square inch, which (if the plate is supported) is a low shearing stress. The plates are supported on four sides with the shearing load applied along one of these sides and resisted along the opposite side. This will produce tension in one direction diagonally across the plate and compression in the transverse diagonal. The compressive force is of a nature that might buckle the plate were it not for the tension holding it straight, and the plates are also held rigidly in one plane along their four edges. With cars having a center sill, and that center sill in tension, from the vertical load, the action of transmitting the buffing load in shear through ¼-inch floor plates is identical with my car, a condition which has existed in the present form of steel gondola cars having center sills apparently without their designers' knowledge of it.

With regard to the stiffeners or stakes on the inside of a car being an obstruction to the load of lumber, I have noticed that the Lake Shore road, in the construction of their gondolas, have all the stakes on the inside of the car, that is, their wooden gondola cars.

I notice some roads out of Chicago have their cars constructed the same way, the Illinois Central, I believe. By having the stakes on the inside you are enabled to place the side wall farther out and increase its width, giving it a greater capacity for granular material or any material that will fit in between the stakes. With regard to a load of lumber, with the stakes as I have them in the car, I think that you will find that it is not a great deal narrower between the stakes at the bottom than other cars with the over all outside limit of width, and that at the top the distance is greater. The cars that I refer to of my design which have been in service since last June are illustrated here by Figs. 13 and 14, an outside and inside view of S. S. C. S. car, No. 4002.

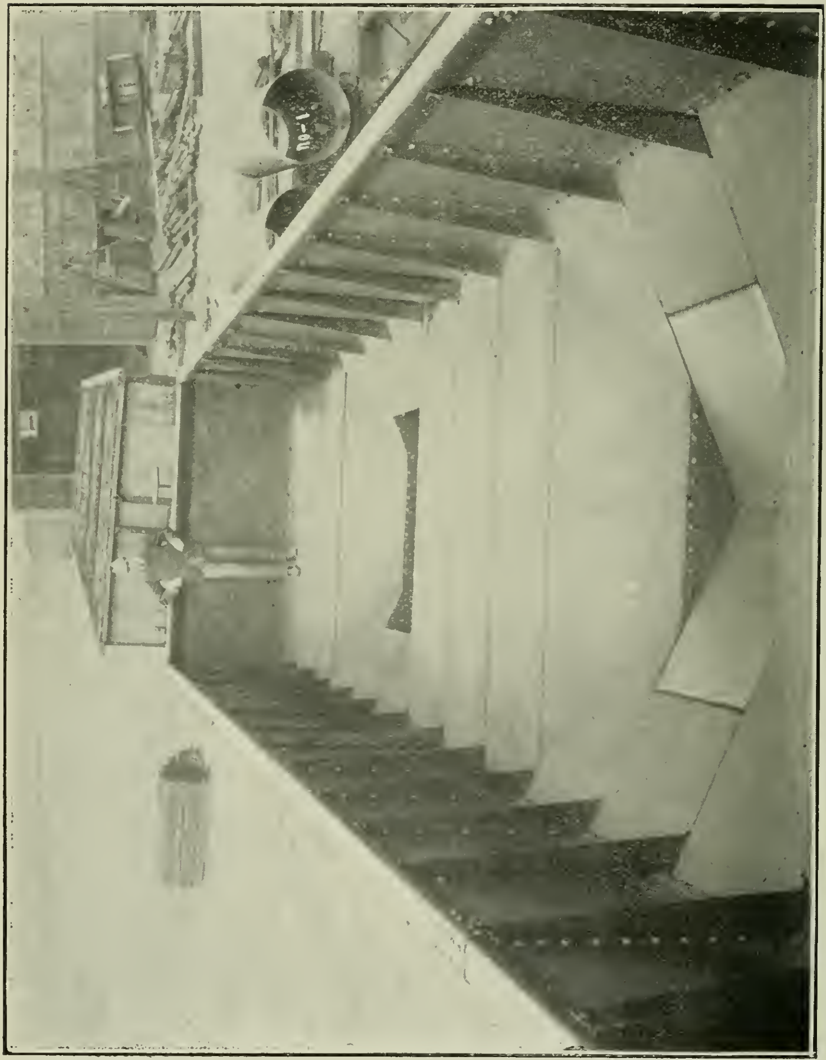


Fig. 13.

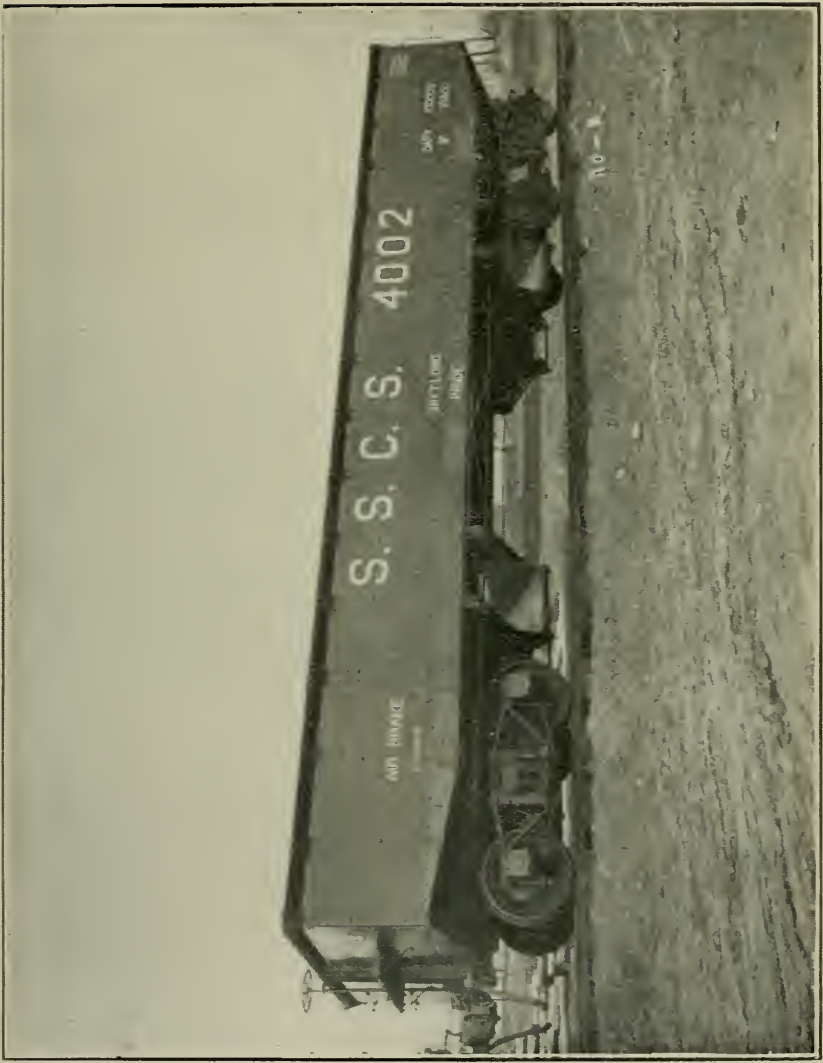


Fig. 14.

The general characteristics of this car are the same as the one illustrated by Figs. 3 and 4. It differs, however, in some of the details, notably the twin hoppers in the bottom, which Mr. Bellows says are "so popular." This, I think, will serve as the "enlightenment" requested by him as to what I propose to do in such a case.

These twin hoppers have a depth of 24 inches below the floor level, and are supplied with chute sides which deliver the load all outside of the rail on either side of the track. This arrangement adds about 1,700 lbs. to the weight of the car. In this car the side plate splices are vertical, and the top of the side plates are bent over outward instead of inward, requiring the small tie plates to support the loose edge of the plate, which, you can note in Fig. 4, is accomplished by the inside stiffeners.

But with regard to the strength of these cars. I loaded one of them with a load of 206,000 lbs. of iron ore, loaded mostly between the bolsters. The load was dumped into the car from a car-dumping machine, taking the load of four other cars and dumping them first into weighed steel hopper cars of The Pressed Steel Car Co. design. We used them because they were handy. We weighed the load and dumped it into the car, heaping it up a foot and a half or two feet above the four-foot sides, making a body of ore over the hoppers about eight feet deep. The load in the ends did not come up to the top of the car by two and a half feet. So that the major portion of the load was in the center of the car. With this load I measured the deflection very carefully by taking a fine sea grass line and stretching it from end to end of the car with a weight hanging over one end so that it would have the same tension before and after the load. I took a set square and set it up against the car and marked the car with a sharp knife at three points on the sides in order to be able to measure the deflection under this load; and the total deflection, as nearly as I could measure it, was thirteen-sixty-fourths of an inch in 28 feet. Taking the moment of inertia of the side girders, the calculated deflection is within one-one-hundredth of an inch of the measured deflection. Of course such a calculation cannot be absolutely accurate, but it was near enough for all practical purposes.

With the car under that load it was hauled around over frogs and switches, and given some shocks with an engine. It showed no deflection greater than that I have spoken of, and the sides at the top did not deflect sideways. The loads for several months in the ore trade averaged about 110,000 lbs. These loads were invariably placed over the pocket, enabling it to be discharged as easily as from a hopper car. With regard to the body bolster construction requiring heavier bolsters in a car of the type I recommend, I think the bolsters in the car should be designed to carry the entire load, for loads placed on top of the car side, as we often get them, will give the bolster the full load. I design the bolsters and the sides of the car to carry the entire load, and I know that they will get it. With cars having center sills and side girders it is a question which will get the load, and you must therefore put excessive material in each member.

Replying to Mr. Shepard's remarks, I do not know that I understand all of his diagrams here, but if I am not mistaken they are all for sloping bottom hopper cars, which is entirely foreign to this paper, and therefore requires no answer on my part.

Mr. Lindstrom's remarks about following Nature in car construction, about backbone in a car, reminds me of some such remarks I have heard before. I would not think of comparing a car which is built to carry a vertical load between two supporting points (the truck centers), with a sword fish which floats in a liquid and has a uniform support for its body from end to end, but I have made some comparison with land animals which travel with their backbones in a horizontal position; in fact, I have made quite a search among the works of that Great Designer, and I have never found one yet with its backbone in its belly. (Applause.) I think the Designer of animal structures is a pretty good one to follow.

This is amusing, but it is the meat of the whole argument. With a so-called backbone almost dragging on the cross ties, and high side girders, which, by their position and connections, simply put the backbone out of business as a compression member, and to cap the climax, after going to so much expense putting in a straight line column from end to end as the most rigid construction obtainable, you spend thirty-five or forty dollars per car on friction draft gear so as to destroy this rigidity.

I think, gentlemen, I have followed the remarks of the other speakers as far as I ought at this time, and have perhaps tired you a good deal. I thank you very much for your courtesy.

On motion of Mr. L. H. Turner, a vote of thanks is extended to Mr. Summers for his very able paper, and also to the gentlemen who have added to the interest of the meeting by their able discussion of the paper.

On motion, adjourned.

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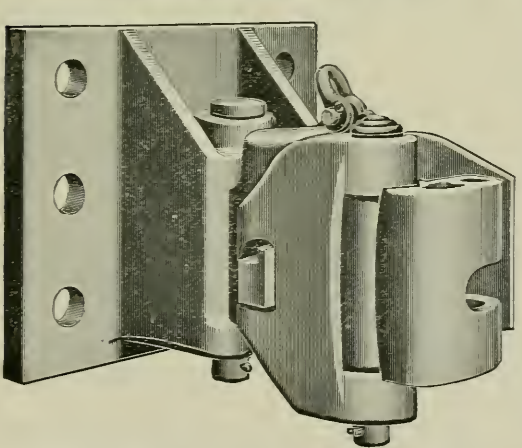

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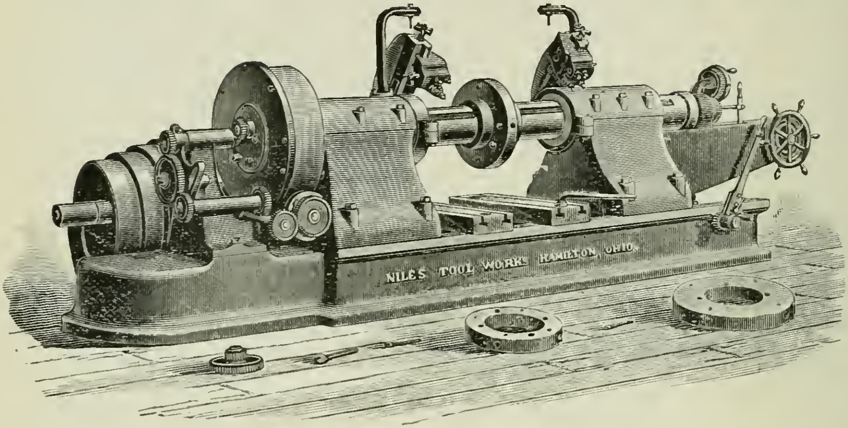
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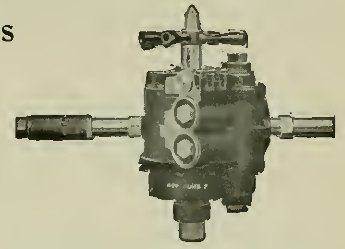

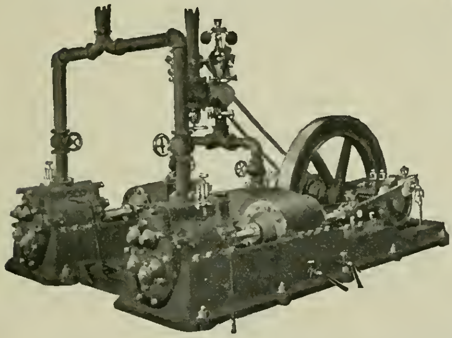

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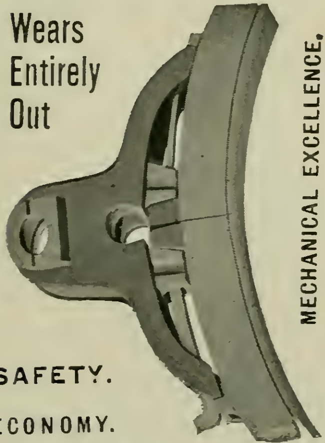
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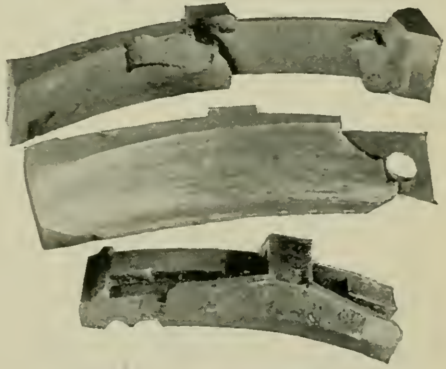
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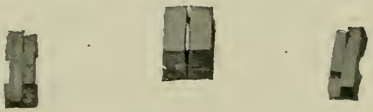
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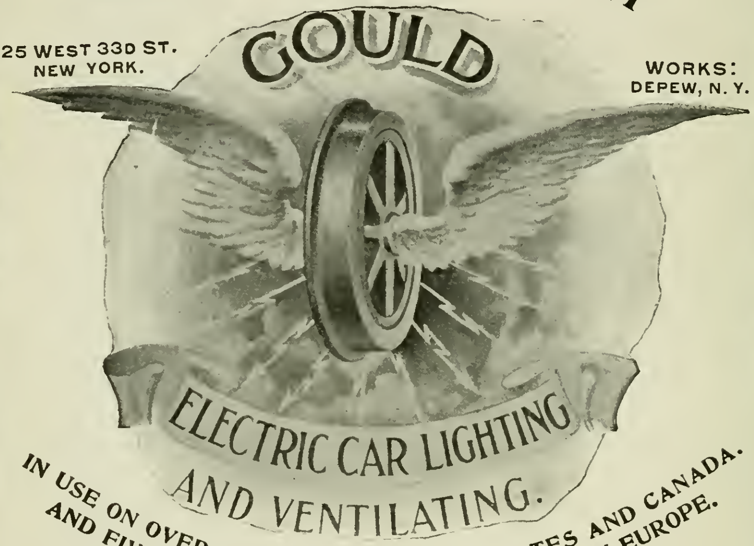

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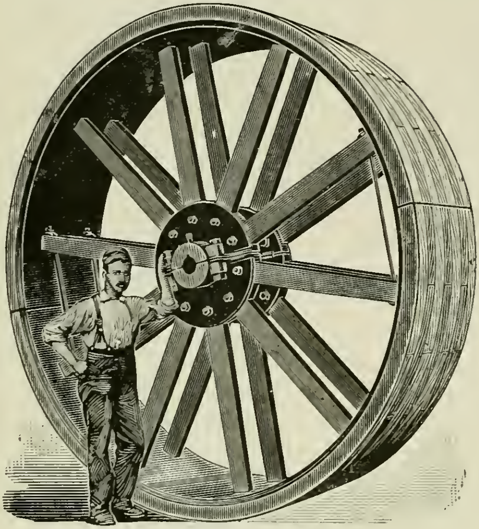

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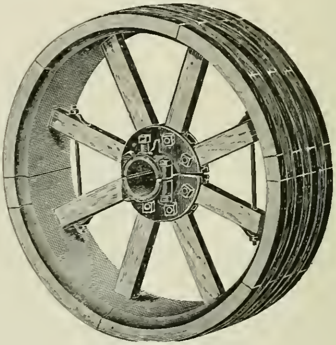

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of the

Railway Club *of* Pittsburgh.

ORGANIZED OCTOBER 18, 1901.

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Pittsburgh, Pa., April 24, 1903.

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,

APRIL 24, 1903.

The meeting was called to order at 8:00 o'clock P. M. at the Hotel Henry, with President J. H. McConnell in the chair.

The following gentlemen registered:

MEMBERS.

Anderson, Thomas.
Bell, W. K.
Brown, E. W.
Carson, G. E.
Conway, J. D.
Courtney, D. C.
Fitzgerald, Orrin.
Gies, George E.
Grooms, J. C.
Hall, W. G.
Howe, David M.
Hubbell, Ira C.
Hunter, H. S.
Hyndman, F. T.
Kearney, Alex.
Kerr, George M.
Kessler, D. D.
Kirk, J. T.
Lindstrom, Charles A.
Lininger, W.
Macoubray, R. J.
Malloy, M. A.
Mason, Stephen C.
Maury, George P.
McConnell, J. H.
McCormick, W. H.
McCracken, John.
McFeatters, F. R.
McIlwain, J. D.
McNulty, F. M.
McVicar, G. E.
Oates, George M.
Quest, W. O.
Reagan, P. J.
Redding, D. J.
Richardson, W. P.
Scheck, H. G.
Searles, E. J.
Shaler, Fred. J.
Soles, G. H.
Stark, F. H.
Stucki, A.
Summers, E. W.
Tucker, John L.
Turner, L. H.
Weisbrod, J. F.
Wood, C. V.
Wright, R. V.
Wright, William.

VISITORS.

Aldcorn, Thomas.
Allen, J. P.
Bogue, John H.
Dambach, C. O.
Hayward, Henry S., Jr.
Kirk, Laurence.
McKee, D. L.
Nickel, J. Kelso.
Partington, James.
Pressinger, W. P.
Smith, Sion B.
Ward, John.
Winlo, R. Canning.

The minutes of the previous meeting being in the printer's hands, the reading thereof was dispensed with.

The Secretary announced the following list of applications for membership:

Scott R. Hayes, Representative, Railway Steel Spring Company, 71 Broadway, New York.

Benjamin E. Tinstman, President Columbia Graphite Company, Farmers Bank Building, Pittsburgh, Pa.

Charles L. Gately, Representative, Gold Car Heating and Lighting Company, Frankfort and Cliff streets, New York, N. Y.

John Gillen, Draughtsman, P. & L. E. R. R. Co., General Office, Pittsburgh, Pa.

J. B. McIntire, Chief Engineer, St. Clair Terminal Railroad Company, Frick Building, Pittsburgh, Pa.

James H. Sewall, Representative, Star Brass Manufacturing Company, 108-114 East Dedham street, Boston, Mass.

Archibald M. McCrea, Vice President, Union Spring and Manufacturing Company, Frick Building, Pittsburgh, Pa.

Leonard G. Woods, President, Union Spring and Manufacturing Company, Frick Building, Pittsburgh, Pa.

H. T. Anderson, Chief Draughtsman, Standard Steel Car Company, Frick Building, Pittsburgh, Pa.

A. E. Ostrander, Draughtsman, Standard Steel Car Company, Frick Building, Pittsburgh, Pa.

H. C. Lafferty, Master Painter, Pressed Steel Car Company, Allegheny, Pa.

M. C. Blest, Chief Draughtsman, Pressed Steel Car Company, 1720 Buena Vista street, Allegheny, Pa.

John S. Sullivan, Master Blacksmith, P., C., C. & St. L. Ry. Co., P. O. Box 50, Dennison, O.

Moore Kelly, Representative, Ajax Metal Company, Second National Bank Building, Pittsburgh, Pa.

E. W. Lininger, Chief Clerk, Pressed Steel Car Company, Allegheny, Pa.

President: Gentlemen, on the recommendation of the Executive Committee, these gentlemen will become members of the Club.

Thomas Lindsay.

The committee appointed to prepare resolutions on the death of Thos. Lindsay, a member of the Club, present the following:

Whereas: We learn with sorrow and regret of the death of our esteemed member, Thos. Lindsay, who was born in Steubenville, O., January 29th, 1839. The greater part of his life was spent in railroad circles. In his early life he held the position of Master Car Builder with the Beaver Falls Car Works, John L. Gill Car Works, Youngstown Car Works, Woodrull Sleeping Car Co., Swissvale, Pa., and the last 17 years of his life were spent with the B. & O. Railroad Co. He was a man of wide acquaintance, and was beloved and esteemed by his associates, both in a business and social way. He died in this city March 24th, 1903, after an illness of five months duration.

Whereas: His uprightness of character and fair and honorable treatment in all his business relations, as well as his courtesy and kindly interest in those who were associated with him, have endeared him to us all, and,

Whereas: His life and character has always been such as to commend itself most highly to all classes of people, therefore, be it

Resolved: That we herewith place on record our high appreciation of his sterling qualities and believe them to be worthy of emulation, and be it further

Resolved: That we extend to his sorrowing family our sincere and heartfelt sympathy, hoping that He may alleviate their grief in this, their great bereavement, and be it further

Resolved: That these resolutions be spread on the minutes and that a copy of the same be presented to the family.

GEO. E. GIES,
F. McNULTY, } Committee
G. E. CARSON.

The Secretary announced the death of one of our members, Mr. Thomas Lindsay, one of the charter members of the Club, whereupon the Chair appointed the following committee to draft suitable resolutions on the death of Mr. Lindsay: Mr. George E. Gies, Mr. F. McNulty and Mr G. E. Carson.

President: Gentlemen, the next order of business will be the presentation of the paper of the evening, entitled "The Locomotive Steel Frame and Its Repairs," by Mr. A. W. McCaslin, Master Blacksmith of the P. & L. E. R. R.

"THE LOCOMOTIVE STEEL FRAME, AND ITS REPAIRS."

BY A. W. McCASLIN, MASTER BLACKSMITH, P. & L. E. R. R. CO.

The above subject should interest not only the foreman blacksmith, who in a manner is held responsible for the results or behavior of the work passing through his department, or the Master Mechanic, whose energy in determining the cause of failures frequently pushes the foreman dangerously close to the edge, or even the Superintendent of Motive Power, who is inclined to pronounce the word failure, a corruption, or as being entirely void of meaning in its application to the performance of the motive power, but to all officials of all railroads, who have the best interests of their respective roads in mind ; nor should we forget the traveling public whose safety is, or should be, given paramount consideration from the highest official down to the apprentice boy in the shop. This is termed the steel age, owing to the fact that Mild steel, through its superiority over iron for some purposes, has to a material extent, superseded the latter. Steel is at the present time being quite extensively introduced, and one would think without a voucher as to its reliability, into one of the most expensive as well as fundamental parts of the locomotive. If compression, tensile and torsional strength were the only requisites of a perfect material for locomotive frames, steel would indeed be the ideal metal, but where shocks and vibrations are factors, we approach danger in its use. We know of no other member of the locomotive that is required to withstand, per square inch, that expected of the frame. Steel is not a universal metal, and can not be used indiscriminately or regardless of the laws governing metallography or metallurgy, but, like men, should be chosen only to fill the positions it is best fitted for. No thinking mechanic would accept a new locomotive frame made from crystallized iron, with its tendency to separate, from the least shock. Steel is also "crystalline." We doubt if there is a Superintendent of Motive Power or a Master Mechanic on any of our railroads who would accept a new engine frame made from granular iron, with its disposition to fracture or separate from shock, identical with that of crystallized iron when there is the least flaw or imperfection as to soundness of its surface. Steel is also granular,—and every hole drilled into it makes its liability almost a certainty to fracture at that point, if subject to shocks. True, steel has greater tensile strength than iron, but certainly at the expense of ductility. The best authorities on steel claim the highest tensile strength and greatest ductility can not be had together. If it were possible to combine the highest tensile strength of steel, and the ductility of good fibrous iron, the problem of not only a proper, but the best material for frames and many other parts of locomotives, coaches, cars, etc., would be solved, and who could estimate the saving in dollars to railways in general, through the decrease in failures or breakages, frequently termed accidents.

In casting a locomotive steel frame, owing to its length and irregular shape, we believe it necessary to gate or pour the metal at several points ; thus, in a manner, casting it in sections. Does this metal retain the proper degree of temperature or fluidity, after traveling from four to six feet, as the case may be, to form a perfect union with the same metal at the same temperature from the next or neighboring pour? This would be possible when pouring large volumes of metal, if the pour be constant, but can we have perfect faith in the union of such metal when poured at intervals of four to six feet into a mould with a sectional area of only sixteen to twenty-five square inches, owing to its tendency to cold-shut at point of supposed union.

Let us reason. If this metal be poured at the proper temperature to make a perfectly solid casting retaining its full virtue as to specified strength, ductility, etc., what will be the percentage of these virtues at point of union, effected at a lower temperature occasioned by travel of metal through the mould some distance from the pour? Invariably it is necessary, when casting ingots, to cut from them what is called the piped end, which is constituted largely of the dirt and other impurities in the steel, which settles at top end of ingot. If this is necessary in order to procure a perfect or sound billet from which, through lamination a solid bar of refined steel can be produced, what are the conditions of this metal in a steel frame with these imperfections and impurities uneliminated, and distributed throughout the frame, the effect of which we fear are not always considered.

If we have been observant we have noted, in the many broken steel castings that come into the shop, a cavity at point of breakage, around which can also be seen the impurities in the steel, which settled at that point. Nor should we be unmindful of the fact that the consequent ill effects of all imperfections as to unions as well as impurities in the steel, are greatly augmented by uneven contraction, which annealing does not always entirely relieve.

We know of no degree of temperature that a sectional area of twelve square inches at a much higher temperature will not more than speedily meet or drop to than is possible with a sectional area of twenty-four square inches. If the argument be worthy of thought, I would ask How can a long frame-back with a sectional area of twenty-five square inches cool or contract evenly with the braces or bottom rail with a section area equal to only one-half that of the back, without leaving a strain somewhere in the frame regardless of the method of annealing?

We are told by some steel men that castings made from open-hearth steel, containing a specified percentage of carbon, which is one of its life-giving components, do not run regular throughout as to points in carbon. Thus a frame made to specifications or formula, calling for thirty points in carbon, is liable to contain thirty points at one end, with twenty points at other end and fifteen points in the middle, etc., which would make a frame of an unknown quality at any given point, with possibly its weakest section where greatest stress or abuse is to be met. I have been told by men who have straightened many steel frames under the steam hammer after they were annealed, that they sometimes break in two in the middle by a blow from the hammer ; others will break off near the end through shock or jar, which certainly shows feeble tenacity, but this should not surprise us when we understand that steel ingots sometimes crack in two or three places, even after they are supposed to be cold, which doubtless is due to internal as well as external strains, caused by uneven shrinkage, combined with the left-over impurities in the steel, and through lack of reheating and the refining process under the hammer.

After the frame is cast, machined and placed in position, what have we of any value or that can be vouched for aside from proper design and dimensions ? Placed in service, we await results, which frequently means a loss that some of you gentlemen can compute more easily than I. It is simply the addition of cost of repairs to that of engine out of service through broken frame. Some might ask at this point, will a given number of steel frames show a greater number of breakages than will the same number of good fibrous iron frames, doing same service under same conditions ? Will say, that I have recently learned that on one of our neighboring railroads, they have, within the last six months, had thirty-five steel frames break on their engines of the consolidated class, and only one wrought iron frame broken in the same length of time. This great number of failures in the steel frame in such a short period of time, would probably cause one to think some of these breakages due to improper designing of frame. If this be true, who of us would care to take the responsibility of having placed an incompetent man at this very important, or we might say, one of the fundamental parts in the construction of locomotives? Has any one ever known such a number of broken steel frames to be paralleled with a like number of breakages in good fibrous iron frames, doing like service, under similar conditions, in the same length of time, even when the steel frames in service have been outnumbered by the iron frame from three hundred to four hundred per cent., including, as this would, those improperly as well as properly designed.

I hear many complaints from foremen smiths on many of our railroads as to the great number of breakages in steel frames, which would indicate that wherever the steel frame goes, trouble accompanies it. How shall we repair this broken steel frame? As a blacksmith with thirty-five years experience in the manipulation of iron and steel, I know but one proper way, that of laying in, the side "V" weld, sometimes called the angle weld. In the preparation of parts for this style of weld, the sides of frame at breakage should be driven well back, in order to gather sufficient stock for upper end of wedge piece to properly weld upon. This weld is generally made at an angle of 90 degrees (figure 1), but think an angle of 110 degrees better, (figure 2), as it requires a longer lap to make a secure weld in steel than it does in iron, and with the obtuse angle, the piece laid in is less liable to slip or drive past its first contact with the walls of aperture in the frame, and will weld by first blow from the hammer, there being less tendency to shear in the weld.

In welding broken steel frames and iron frames as well, the lay-in pieces are usually made of iron, and the fibre should always run with length of back, limb or brace, according to location of breakage. This style of weld made with a clean heat, we do not think can be excelled, but it should be remembered that any weld made with dirty or sulphurous fuel, is a counterfeit, and can not be guaranteed, and I am pleased to be able to supplement this fact by saying railroad officials, as a rule, do not long retain the foreman or his subordinate who knowingly jeopardize the best interests of his company by placing in service articles showing faulty workmanship or unreliable material, which gives official recognition to the fact that a sufficiency of the best rather than a super-abundance of the inferior, is true or lasting economy.

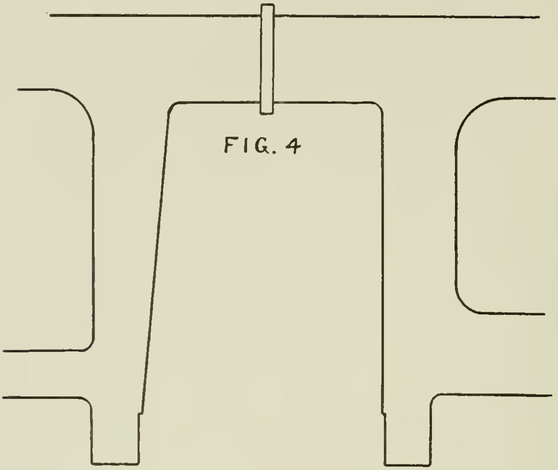

FIG. 4

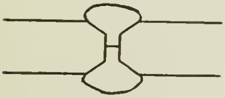

FIG. 3

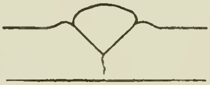

FIG. 1

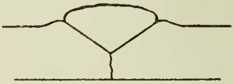

FIG. 2

We frequently hear of blacksmiths whose ingenuity and reasoning become entangled, and in their efforts to a speedy way out of their dilema, resort to butt welding the steel frame, and by so doing entirely disregard the nature of material they are handling, as well as the fact that a slow compression force will not effect a perfect weld, and even undertake to butt weld this frame without removing it from the engine, when their past experience and best judgment would teach them that the most secure weld of any style requires a rapid succession of blows.

The method of butt welding the steel frame without removing it from the engine consists of separating it at breakage and inserting a piece of wrought iron, which should protrude from one-half inch to one inch on the four sides of frame (Figure 4). A furnace from eight inches to twelve inches square is then built around the broken parts, and air and oil used as fuel. When the broken part arrives at proper welding heat, if it is impossible to use battering ram, which is generally the case, the frame is pulled together at weld with screw rods, or by some other equally slow means, and the parts dressed up with light hammers, and the butt welds, for there are two of them, one on either side of iron inserted, are completed, but with this method of welding, only the first installment of expense in the repairs of the frame has been met A combination of the angle and butt weld would be preferable, (figure 3). Were it possible for this butt weld to remain intact, the frame would break on eitherside of the weld, through the fact that this steel casting even after it has been annealed, is in a raw condition, and every square inch of this steel encased in the furnace for the purpose of heating the parts for making the weld, be the furnace six inches or twelve inches long, is brought to the same high heat required to effect the weld, and when this weld is accomplished, this metal of granular or crystalline structure is left in a more-open spongy, as well as over-heated condition, which, through lack of hammering or lamination of any kind, is invalidated for service.

If there were no impurities and defects in the frame, and it should break through the solid, how can we expect good results from a weld with a tensile strength of only sixty to eighty per cent. of the original strength of material, the lap or angle weld being the only weld that can be guaranteed to approach the initial strength of bar or frame. One might also ask what the verdict would be regarding our sanity as to proportions and mechanics in general when we pretend to repair this broken frame by drilling it full of holes and bolting on a patch with a sectional area equal to only one-half that of the broken section.

If we must have the steel frames with their present failures, we think the proper place to repair not only them, but the iron frame as well, is in the blacksmith shop under the steam hammer or on the anvil, making the best weld known, the lap or angle weld, paying strict attention to expansion and contraction of all the parts to avoid transmitting an undue strain to the limbs, which also include the braces.

If the disease calls for quinine, we believe in administering quinine, but should it be necessary to amputate the leg of a steel frame, do not replace it with cork ; use good refined fibrous iron

Note. The above paper refers only to the locomotive cast steel frame, and not to laminated mild steel.

President: We have before us this evening a very interesting subject, and one on which a great deal can be said on both sides. Not all the good things of this country come out of the West, but quite a good many of them. And we have a good thing with us this evening, and that is the representative of the Amercan Steel Foundries Company, Mr. Ira C. Hubbell, assistant to the Vice President, who has kindly consented to open the discussion.

Mr. Ira C. Hubbell: Mr. President and gentlemen: My consent, to which the President has referred, has been obtained somewhat upon a parallel with the man who meets another man after the sun has gone down and says "Hands up!"

Some years ago a man left his home in Ireland and preempted 160 acres of land in Kansas and set up his home. And the story runs that one of the first things established on the place was a good pig sty. In time a brother came over to visit the Kansan, and he took him out to show him the place. He showed him the pig pen and said, "What do you think of that?" "Well, I don't know; it is much like what we have over there; quite the same. I think you have done very well." And so he took him around in the same way and showed him all over his Kansas home and got the same response, "You have done very well; it is much the same as we have over there." Finally he got around to the place where he kept his bees. And he says, "Have yees any bees over there?" "Oh yes. We have them over there much the same as you have, but ours, I think, are about five times the loikes of them." "Do you have a hive like that with a little hole like that for the bees to go in and out of?" "Yes, I think so; much the same." "And you say your bees are about five times the size of these?" "Yes, I think so; fully that, I think." "Well, if your bees are fully five times the size of these, how do they get in and out of a hole the size of that one?" "Oh, I dunno that; that's the bees' business."

It is the business of our general superintendent to be here to-night to tell you something about what is called cast steel, because I am not a cast steel maker. I have only been associated with the production of cast steel in the capacity of a manufacturer and seller of it but a very few months. What

I know of cast steel—which I prefer to call open-hearth steel—has come from having been a pioneer in its use in connection with railroad equipment. I think I placed cast steel under the first lot of cars of any particular number, in which the material was ever used. I recall, when connected some years ago with the Denver & Rio Grande Railroad Company, when we undertook to use the first steel castings in connection with locomotive work. And those of you who have followed the product for a matter of twenty years past will remember that in the early days we had a great many very trying and annoying experiences with the material. Those who have been engaged in manufacturing this product have in the twenty years made remarkable progress, and to-day the American Steel Foundries have near St. Louis two plants producing close to 7,000 tons a month, all of which metal goes into truck and body bolsters. We have made at one of the plants a few locomotive frames for one customer. We produce a metal which, I think, is distinctive, and which will probably approximate an average of 65,000 pounds tensile strength, showing an elongation of 24 per cent. and a reduction of area of 34 per cent. in a two-inch section. It has been said that you can give each of two men a pile of lumber; one man will make kindling wood and the other will produce a house. A like result will be obtained along almost any line. I am very sorry that our general superintendent could not be here, because he could give you some of the details of making this metal, which I cannot do.

I want to thank the gentleman who has prepared this paper for what he has said, in that he has given those engaged in producing open-hearth steel something to think about. I am not in entire sympathy with all of his comparisons, and prefer a little later to talk on some points of the paper. But I want now to say this, that there is no reason why we cannot produce a locomotive frame of the class of material that we are using in our bolsters which will give as satisfactory results in a locomotive frame as it is giving in the bolsters. I have seen cars go through wrecks where the axles had been bent at right angles, and have taken the body and truck bolsters and used them in repairing the cars without taking them to the shop, without the necessity for doing any work on the body or truck bolsters. I have seen Granite City bolsters which came into our St. Louis plants from somebody's tender, where the bolster was twisted all out of shape, but it had on each end a piece of the wrought frame of the tender, showing the cast steel was the stronger.

President: There is another gentleman here interested in the steel-casting business. I do not know whether he will say anything or not, but I am going to ask him. Mr. Jas. P. Allen, of the Union Steel Casting Company.

Mr. Jas. P. Allen: Mr. President: I really have not had much opportunity to prepare myself to speak upon this subject. But being interested in the manufacture of steel castings, although we do not make engine frames, there are some points about which I would like to say a few words.

Although, as I said, the company with which I am at present connected does not manufacture engine frames, my previous experience gave me an opportunity to observe not a little on this subject. There are some points in Mr. McCaslin's paper on which it seems to me he must have been more or less misinformed, in regard to the practices and phenomena which obtain in producing a steel cast frame. I would first refer to that part of the paper relating to the pouring of the metal into the casting. Now it is the practice in casting a locomotive frame to pour it from a down-take runner or pouring hole, which connects with a long gutter-like runner, is parallel with the entire length of the frame, and from that there are small gates or openings into the casting through which the metal flows into it. Now the pouring is all done through one hole, the gutter-shaped runner is larger than the gates connecting with the casting, and it quickly fills and the metal runs into the casting through those several gates simultaneously. While it is true it does cool more or less as it runs into the mould, certainly not sufficient to prevent a perfect union when the metal comes together in the mold. The back of the frame, I believe it is called, or the top rail which is continuous throughout the frame, acts as a runner, in a sense, for the braces running across the frame: and there are tie pieces cast across the pedestals, openings of about the same size as the braces on the lower side of the frame, which also act as runners and assist in producing a uniform contraction and shrinkage of the frame. These ties are cut out of the frame after the casting has been shaken out of the mold and annealed.

There is another point where the paper speaks of the piped ends of ingots. Now in producing an engine frame there are sinking or feeding heads cast on it at intervals along the frame whereby the metal is fed into the casting as it shrinks. These in a sense act the same as the ends of the ingot which is cut off and thrown aside. These openings are quite large and any dirt, a little sand or something of that sort that might lodge in the mold, as a rule floats up through these sinking heads, which are removed from the casting and thrown away. Therefore the steel cast frame is in that regard fully equal to the ingot after the top end has been cut off and destroyed.

Now as to uniform composition of the metal, I can say that in those shops in which their shop practice is right, and their melting practice is properly performed as it is to-day in the principal steel casting plants in the country, there is a perfectly uniform metal produced, and I am quite sure that if you would take the frames of any of the principal manufacturers and take tests at places along the frame you would find the composition very even, varying little if at all. There may be a variation of a point or so, but practically none.

As to annealing, the same remarks would also in a sense apply. Annealing is not done now by hit or miss, but is a thing which is quite fully understood, and when a casting is properly annealed the strains are removed that have set in during the contraction, or shrinking of the casting, through the fact that the parts of the mold or flask in which cast, holds and prevents certain parts of the casting from shrinking freely. The removal of the strains is partly due to the fact that the casting in annealing is expanded beyond the point where the strains set in, and when it cools there is not the same obstruction to prevent contraction as there is in the mold, and principally because the structure of the metal is changed. The molecular formation is quite different after the annealing has been properly performed.

As I said, we ourselves do not make the many engine frames spoken of, although we do make front frames and driving wheel centers and all the other miscellaneous castings that enter into locomotives, and the great majority of them under the tests and inspection of the railroads for which the locomotives are intended. And we invariably have surpassed the specifications laid down by the railroad companies. Our rejections are practically nothing from that source, the results running about 65,000 pounds per square inch, tensile strength, with an elongation of about 25 per cent and a reduction of area very close to 40 per cent in two inches. These results are obtained right along, demonstrating what a uniform steel cast product can be and is produced.

President: Mr. Partington, can we hear from you?

Mr. James Partington: Mr. Chairman: It occurs to me that to make a just comparison between iron and steel frames we must have the same conditions. Now the locomotive builders throughout the country have built a great many steel frames in the last few years, and necessarily those steel frames have been put into locomotives of high pressure and great power. And, in the last five or six years the strides in locomotive building have been great, and these machines are subject to a great deal more excessive strains than locomotives of older types. The Pittsburgh works of the American Locomotive Company has not built a great many locomotives with steel frames, in comparison with the other builders, and I do not know of a single case where an order has been turned out having part steel and part iron frames, either there or anywhere else; and it seems to me that such a test is necessary before you can speak authoritatively on the relative merits of the two.

The railroad Mr. McCaslin mentions I think I know of, and the iron frames on that road are almost altogether on engines of light power and on engines that are all of them probably old enough to have broken their iron frames and had them replaced with heavier ones. There are a number of railroads that are now specifying steel frames and would not have anything else. I know of a case in point at present where a railroad has had considerable trouble with iron frames, and is replacing some of them with steel frames, and is going to the expense of new patterns for a few frames, which necessarily increases the cost materially. On the heavier motive power that is being used to-day, if a frame is not properly braced, I care not whether it is iron or steel, it will break. There were a great many frames broken on a road coming into Pittsburgh in the last two or three years on that account. These frames were all iron frames. If they had been steel of course that would have been used as an argument against steel frames.

I think the steel frames that are being made to-day are good frames, and I think they are perfectly trustworthy as far as we have had opportunity to judge. At the Pittsburgh works any steel frames that we have furnished have as far as we know given no trouble. I do not recall a single case where we have had a complaint of broken steel frames.

I had occasion the other day to go to a town adjacent to where we were having some steel frames made in a steel foundry. Some of these frames had been delivered to us and they were somewhat warped, and it was thought desirable that I should go to the foundry to see if they could not remedy this. I went over to see them and they told me their facilities for straightening frames were not very good. I went into the shop and examined those they had on hand, and found that some of these were warped, but they agreed to straighten them. I was rather curious to find out what means they would take to straighten them, as they had already told me they had no straightening plate, and no press. I had just previously read the advanced copy of Mr. McCaslin's paper, so when they told me they were going to heat these frames and put them under a drop ball it almost took my breath. I asked them how many they broke in that way. I expected of course they had broken some; but they told me they did not break any. Now if they can take these steel frames and straighten them in this primitive fashion, I think they ought to stand for some of the jars and shocks they get on a locomotive.

President: This subject, gentlemen, is open for discussion, and an opportunity offered now to everybody who has anything to say. Mr. Wright, can we hear from you?

Mr. R. V. Wright: In looking into the subject of cast steel locomotive frames it seemed to me that part of the failures which have occurred might be due to poor design. Several of the cast steel frames which I have examined have been of the same design as the wrought iron frames which they replaced.

As Mr. McCaslin has very clearly shown in his paper, there is a great difference between the structure of wrought iron and cast steel. Wrought iron is a fibrous material and consists of a number of small fibers which are welded together. Cast steel, on the other hand, is crystalline. The strength, ductility and hardness of the cast steel depends to some extent on whether this crystallization is fine or coarse. The crystallization depends on the composition of the steel and the heat treatment it is subjected to after being cast. If continually subjected to heavy shocks the crystallization becomes coarse and the metal becomes brittle.

It would therefore appear that a larger factor of safety should be used in designing a frame of cast steel than for one of wrought iron. Cast steel, on the other hand, can readily be cast in any section, and it would seem that a better distribution of metal, as far as strength is concerned, could be obtained by using other sections than the rectangular shape, which is standard for wrought iron frames.

Cast steel is practically in its infancy, and even the steel foundry men who are present must admit that there is still much to be learned concerning the proper handling and working of it. It is in some respects a rather uncertain material, and for this reason also a greater factor of safety should be used than for a wrought iron frame. In order to increase this factor and yet not add materially to the weight the design of the frame would have to be changed quite radically.

The paper calls attention to the fact that the top rail of the frame has about twice the cross-sectional area of the lower rail, and that the difference in the rate of cooling would cause serious shrinkage strains. There is no question but what this is a bad point in design for cast steel and that it should be remedied by changing the design so that both members will cool at the same rate.

Toughness and ductility must, of course, be sacrificed if we wish to increase the tensile strength of cast steel, but for a mild grade of cast steel the strength and ductility should compare very favorably with a good grade of wrought iron. The American Standard Specifiation for Merchant Iron, Grade "A," requires a minimum tensile strength of 50,000 pounds per square inch, with an elongation of 25 per cent. in eight inches. The specifications for a "soft" grade of cast steel require a minimum tensile strength of 60,000 pounds per square inch, with an elongation of 22 per cent. in two inches.

The Railway Age, in a recent editorial, calls attention to an improvement in the molding of cast steel due to the use of green molding sand. Until recently the dry sand was considered better, but some of the foundrymen out west have been using green sand with splendid results. The green sand is supposed to let off steam when the metal strikes it, and this is supposed to develop blow holes. Apparently this action, if it does take place, is not serious, for castings made with the green sand are just as sound as those made with the dry sand. Moreover, the green sand gives way when the metal begins to shrink; and shrinkage strains are not as severe as when the hard dry sand is used. This is a very important factor in making a locomotive frame which will shrink eight or ten inches in its length. The green sand castings clean up much smoother than those made in dry sand. The green sand does not burn into the metal as does the dry.

The question of proper annealing, which was mentioned by Mr. Allen, is also an important one. Some of the steel foundries do not give this subject the proper amount of attention, and no doubt a great many of the breakages of cast steel frames are due to improper annealing. This operation is a scientific one. The metal should be brought to a certain critical point and then be allowed to cool. If the temperature is not carried high enough or is carried too high the metal might just as well not be annealed. It is, of course, a difficult matter to get an even heat on all parts of the frame unless great care is taken.

The steel frame should be so designed that it will never have to be welded, for it is a material that will not weld well. When the metal near the weld is heated to a high point it becomes spongy, and unless it is worked will remain so.

Mr. L H. Turner: It is true that we do have a greater proportion of breakages with steel frames than we do with iron. Then steel costs more than wrought iron, and if it be necessary to increase the cross section that will add still more to the cost. I would like to have some of the gentlemen who are advocates of the steel frame say what the advantages are. It costs us more to get them in the first place and we still have the liability to breaking after we do get them.

President: Is there anybody present that can answer Mr. Turner's question?

Mr. Hubbell: I will try to. I am generally ready to talk. The various points in Mr. McCaslin's paper have been brought out and as Mr. Allen has said it seems evident that Mr. McCaslin has not been entirely familiar with what is being produced by certain manufacturers of open-hearth steel to-day. In the rough simile I used with regard to the two piles of lumber and the two men is reference to what I now say. One man will take the raw materials necessary to produce open-hearth steel, and he will produce a better material than another man will. This will bring to a great many of you the inference that the quality of open-hearth is affected by both the sire and the dam. I remember in 1895 visiting a plant that produced this material, and to convince me of what they were producing they cut a gate from a truck bolster about two inches in diameter. It was heated and cut in two and the smith welded it and then it was heated and over the corner of the anvil it was roughed out until it was only about 5-16 inch thick. I have seen metal punished, but I never saw any metal punished like that. Not satisfied with what had been done, the metal was heated and a drift driven through the weld, and in the roughest manner possible, that hole was enlarged until the sides were practically 5-16 inch square, and you could not see the weld. I think, perhaps, that will answer the question that may have been raised in regard to welding.

Not long since I was in the office of a Superintendent of Motive Power who is well known to most of you here present, and while there he received a telegram advising that engine number so and so was in the house with a broken cast steel frame. It did not seem to disturb him any. He dictated a telegram directing that they upset the ends of the fracture, weld on a piece of wrought iron and then weld the frame, and he told me that in his experience he had never known a cast steel frame to break where it was welded. If it ever broke it would break somewhere else.

The comparison in the paper made with reference to cast steel and good fibrous iron is not dissimilar to a comparison we frequently hear on the street by some one who for some reason satisfactory to himself is not willing to unite with a church. To satisfy his good wife that it is not a proper thing for him to belong to a church he picks out as miserable a church member as he can locate, and then brings up the best man of his acquaintance who is not a member of any church and makes the comparison. Now reference was made to a good quality of fibrous iron. Since 1895 to the present time I have bought a great many tons of iron, and I do not believe I have had very many tons of good fibrous iron at the rate at which iron has been sold in the period mentioned.

Mr. Turner asked with regard to the relative cost of cast steel frames and iron frames. I do not know that I am sufficiently informed to clearly answer, but it is my opinion that it would be impossible to get a locomotive frame of the class that is required to-day and is referred to in the remarks of Mr. Partington, made of good fibrous iron, very little if any inside of 7c a pound. We will undertake to supply you with cast steel frames with a good discount on that. Most of the difficulties had in the frames referred to in the paper, I believe, are due largely to a question of faulty design. I believe that any reputable maker of open-hearth steel can produce a cast steel frame, which need not necessarily be heavier in section but lighter than the iron frame, and give better results than can be had with iron frames, unit of value considered.

The making of open-hearth steel is an industry of itself. I quite agree that it is in its infancy, but it is a very healthy infant. It is capable of standing alone. It can even say Papa and Mamma. But if we are going to have anything better to-morrow than we have to-day we must each of us be willing to give up what we have for the better thing to-morrow, and I think unquestionably there will be great progress made in open-hearth steel. I am not sure that there will be such a marked improvement in its quality. The improvement I look for is more in the direction of the foundry practice which will enable us to produce the metal at a lower figure.

We have shown from our daily practice that we are producing a metal more ductile than iron. And while I am on this point I want to say that largely as a matter of demonstration as to what can be done, we made a charge one day which under test showed a tensile strength of 109,000 pounds per square inch, an elongation of 15 per cent. and a reduction of area of 19 per cent. in a two inch section. I do not know of any rolled metal made that will compare with it. As a matter of laboratory experiment and to ascertain in a measure for our own enlightenment as well as for the benefit of the railroads we made a little metal in the laboratory one day showing 100,000 pounds tensile strength, 25 per cent. elongation and 38 per cent. reduction of area. If the time comes when it is demanded I see no reason why that laboratory experiment cannot be carried out in the foundry. We give a great deal of thought and attention to the laboratory part of our work. We give considerable attention to micro-photographs and are careful in the question of annealing and the proper treatment of steel after it is made. And we are frequently called upon by our railroad friends to make chemical analyses for them, and we often find where they send in a piece of metal sometimes from a broken locomotive frame, sometimes from some other class of work, that according to our examination the metal has not been annealed.

In the product of the plants with which I am connected, as I said before, we use practically our entire output in trucks and body bolsters. Among my other duties is the taking up of whatever replacement we are called upon to make. And I can say to you frankly that the number of these occurring in proportion to the product we are sending out is very very small. I referred a little while ago to having placed some of this material under a lot of cars several years ago and I had occasion not long since to look up the question of replacements of that material, and the records show that there has not been one in all that lot of cars. We do not have that experience always, but as a general proposition I am prepared to assert and can establish by our records that our failures in open-hearth steel will compare more than favorably with what I know to be the facts with regard to the use of locomotive parts made of wrought iron, the frames not excepted.

Mr. A. W. McCaslin: Mr. Allen, did I understand you to say that steel frames were poured at one point only?

Mr. J. P. Allen: Yes, sir.

Mr. McCaslin: Is this the general practice?

Mr. Allen: Yes, sir.

Mr. McCaslin: Then I have certainly been misinformed by steel casting men. You said this metal was poured into a gutter or trough-like at one point, and this trough extended the full length of the frame and was gated in the middle and at each end into the mould. You also say the metal is poured into several vent holes throughout the mold. This is certainly just what my paper claimed—pouring or gating at several points instead of one. You also claim even contraction of frame, owing to solid brace being cast across the bottom of pedestal jaws, making the bottom of frame continuous same as the top or back, and that this solid brace is cut from the jaws when the frame is taken from the sand. This might possibly relieve the strain to some extent in the jaws, but the main braces in the frame, running from wheel center to wheel center, are left intact, with the resultant strain due to uneven shrinkage of unequal parts, as claimed in the paper read.

Mr. McCaslin: Mr. Partington, you said you witnessed the straightening of several steel frames without the breaking of one. This seems strange to me, for they frequently do break straightening. Did they straighten the frames cold?

Mr. James Partington: No, they heated them red.

Mr. McCaslin: You said these frames were properly and thoroughly annealed. Now, it don't appear just the proper thing to spend about two days thoroughly annealing a steel frame and heat it red hot and straighten it and throw it down to cool off in a half hour.

Mr. Partington: But they are annealed again after they are straightened.

Mr. McCaslin: That would be an interminable process.

Gentlemen: It appears to be pretty well acknowledged here this evening that the locomotive steel frame of to-day is not what it should be; that it is not reliable. We know locomotive steel frames frequently break and that they are invariably repaired with wrought iron. If the steel frame will not remain an all-steel frame, why bargain it as a steel frame at all? An iron frame will remain an iron frame no matter how often repaired.

Mr. Hubbell says the steel industry is in its infancy; that the steel frame is only a baby, and it will be just the thing when it attains its full growth. Now, gentlemen, if the railroad companies of this country and all other countries wish to go into the business of raising other people's children, they have a splendid opportunity to do so in the steel frame----- "Beer."

R. V. Wright: Gentlemen, I think it proper to thank Mr. McCaslin for his very able and instructive paper and offer a motion to that effect.

Motion carried.

There being no further business before the Club, adjourned.

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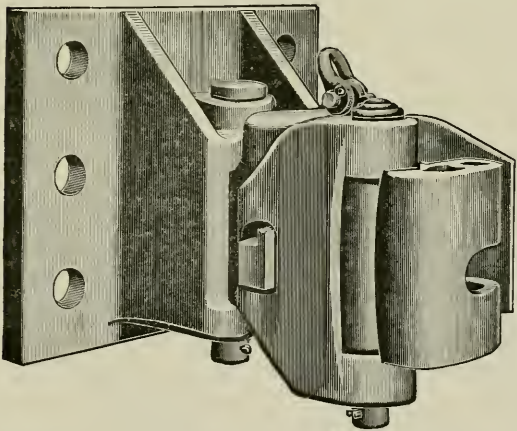

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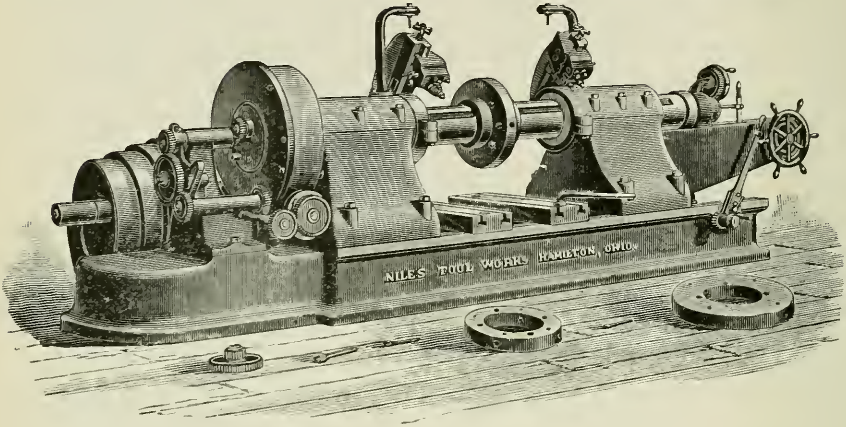
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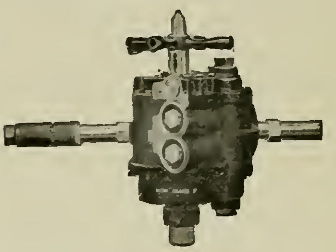

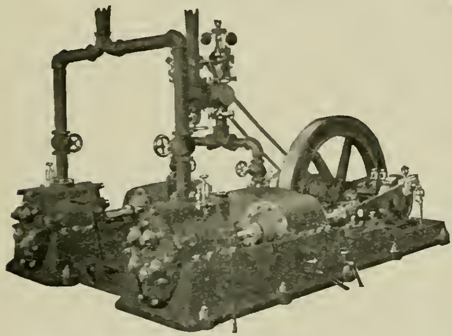

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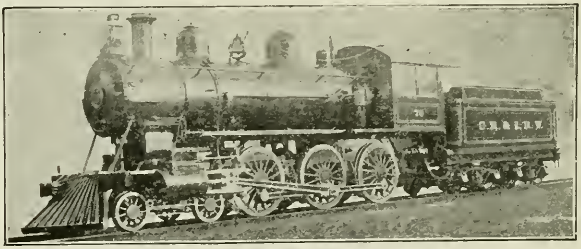

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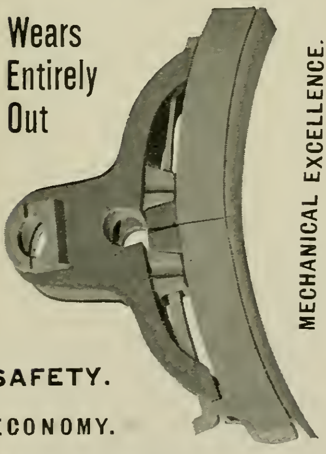

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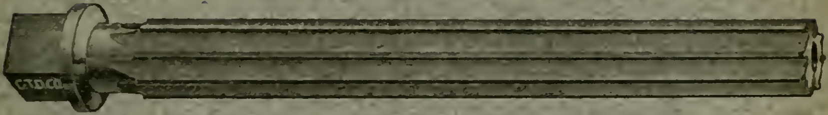

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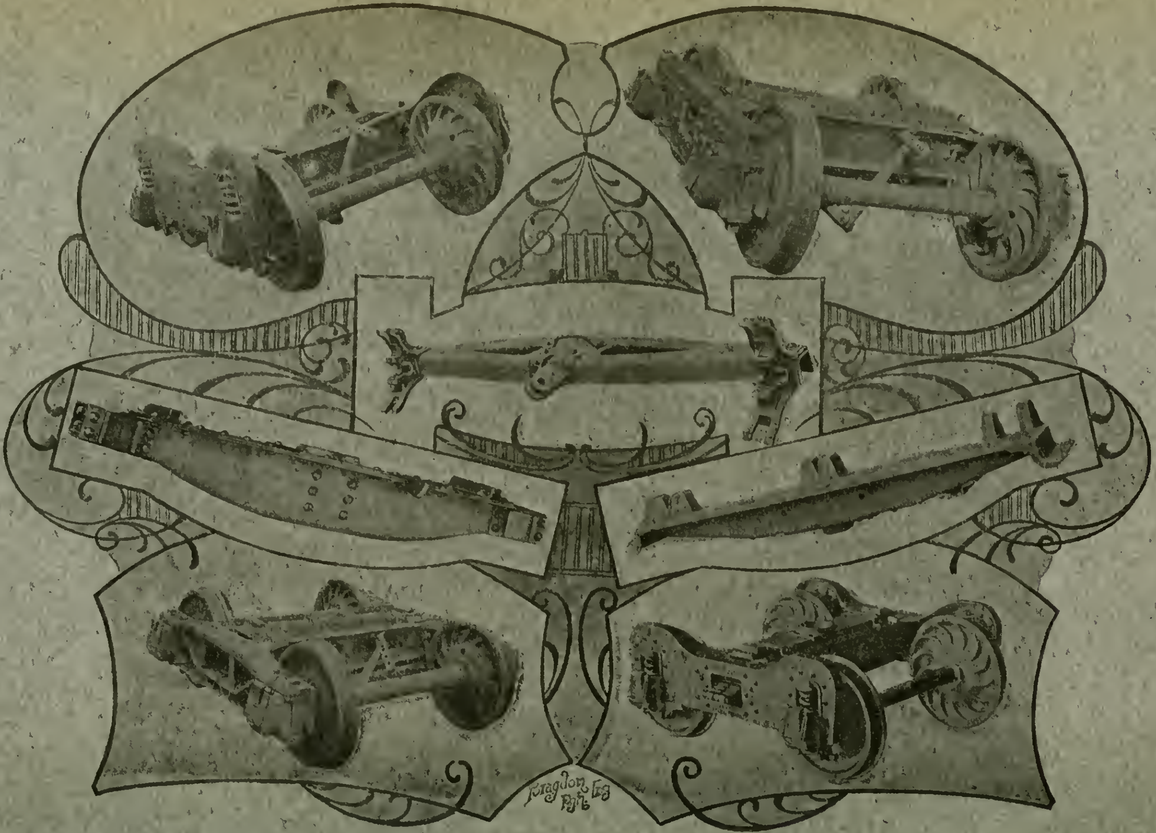

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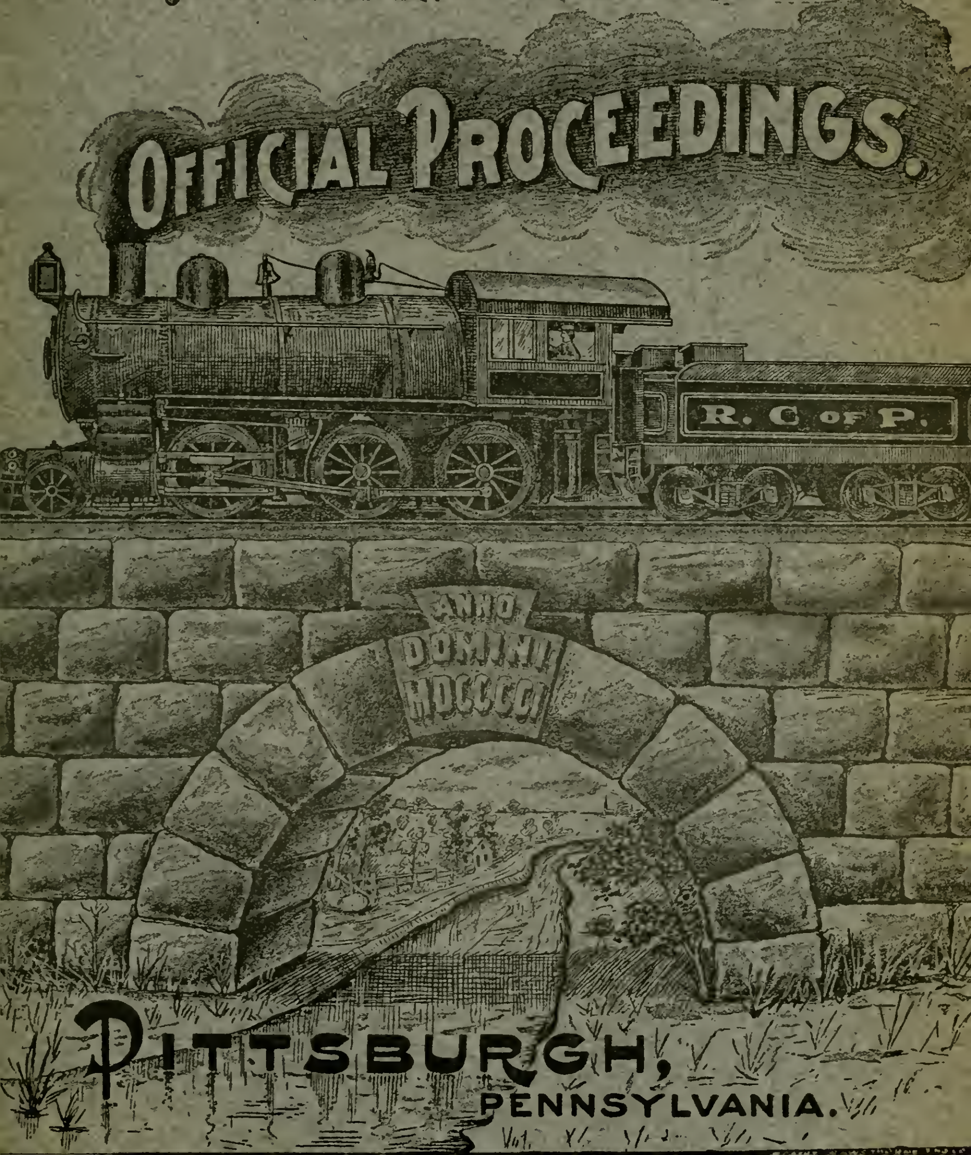

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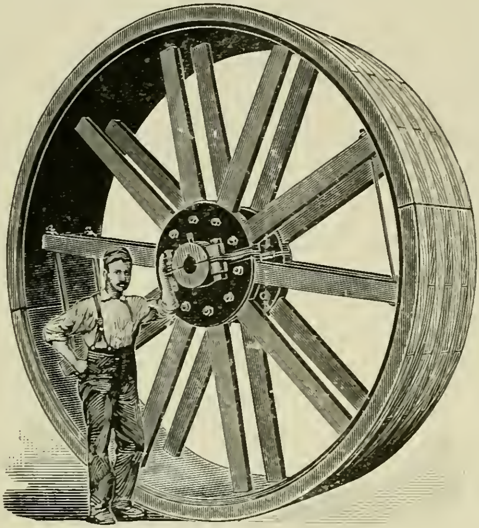

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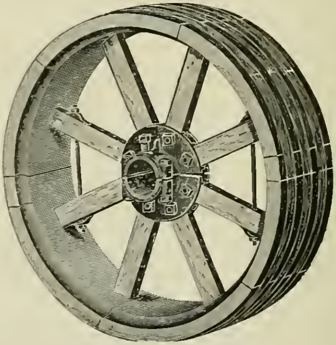

OFFICIAL PROCEEDINGS
of the
Railway Club *of* Pittsburgh.

ORGANIZED OCTOBER 18, 1901.

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Manager American Locomotive Co., Pittsburgh, Pa.

Vice-President,
L. H. TURNER,
Supt. Motive Power, P. & L. E. R. R.
Pittsburgh, Pa.

Treasurer,
J. D. McILWAIN,
Sales Agent, J. D. McIlwain & Co.,
Pittsburgh, Pa.

Secretary,
J. D. Conway,
Chief Clerk, Supt. M. P., General Offices P. & L. E. R. R , Pittsburgh, Pa.

Executive Committee,

D. F. CRAWFORD,
Supt. M. P. Penna. Lines West of Pgh.,
Ft. Wayne, Ind.

J. E. SIMONS,
General Manager, O. M. Edwards Company,
Syracuse, N. Y.

F. T. HYNDMAN,
S. M. P., Bflo., Roch. & Pgh. R. R. Co.,
Du Bois, Pa.

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No. 7.

Pittsburgh, Pa., May 22, 1903.

$1.00 Per Year
20c. per Copy.

Published monthly, except June, July and August, by the Railway Club of Pittsburgh,
J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
MAY 22, 1903.

The meeting was called to order at 8:00 o'clock P. M. at the Hotel Henry, with President J. H. McConnell in the Chair.

The following gentlemen registered:

MEMBERS.

Anderson, Thos.
Blest, M. C.
Conway, J. D.
Diamond, P. R.
Fitzgerald, Orrin
Flinn, C.
Gies, Geo. E.
Grieves, E. W.
Grove, E. M.
Hoffman, N. K.
Holbrook, D. O.
Hunter, H. L.
Hurley, J. L.
Hyndman, F. T.
Keppel, A. M., Jr.
Kessler, D. D.
Knight, E. A.
Lininger, W.
Lininger, E. W.
Lobez, Pierre L.
Macoubray, R. J.
Maury, Geo. P.
Milligan, Jno. D., M. D.
McConnell, J. H.
McCracken, Jno.
McFeatters, F. R.
McIlwain, J. D.
McNulty, F. M.
Noble, D. C.
Oates, Geo. M.
Pelletier, Louis
Perine, D. M.
Proven, Jno.
Quest, W. O.
Richardson, W. P.
Simmons, W. M.
Slocum, A. W.
Smith, D. W.
Stucki, A.
Summers, E. W.
Tesseyman, J. E.
Thomas, F. C.
Thompson, Geo. H.
Turner, L. H.
Warne, J. C.
Watts, H. W.
Weigel, F. S.
Weisbrod, J. F.
Wright, R. V.
Wright, Wm.
J. B. Yohe.

VISITORS.

Black, Prof. R.
Blaney, Prof. H. F.
Eccleson, Prof. W. J.
Johnson, Jno. F.
Lindsay, Master Earl
Mayer, F. H.
Shafer, W. L.
Smith, Sion B.
Stinson, Prof. C. P.
Summers, H. H.
M. S. Tracy.

The minutes of the previous meeting being printed, the reading of them was dispensed with.

The list of applicants for membership was read by the Secretary as follows:

R. C. Winlow, Inspector, Pressed Steel Car Company, Allegheny, Pa.

Jno. P. Allen, Rep Union Steel Castings Company, Sixty-first street and A. V. Ry., Pittsburgh.

James Partington, Chief Draftsman, American Locomotive Company, Allegheny, Pa.

W C. Winterhalter, Sec'y, Champ. Rivet Co., Farmers Bank Building, Pittsburgh, Pa.

L. A. Lee, Chief Operator, P. & L. E. R. R. Gen'l Office, Pittsburgh, Pa.

H. F. Darby, Jr., Rep. Cutter Electric Mfg. Company, Farmers Bank Bldg., Pittsburgh, Pa.

R. L. Berkebile, Asst. Chief Clerk, Pressed Steel Car Company, Allegheny, Pa.

Jacob Jenny, G. F. C. R., Monon. Div., P. R. R. Co., Thirty-second street, S. S., Pittsburgh.

W. E. McFarland, Asst. R. F. of E., Monon. Div., P. R. R. Co., S. S., Pittsburgh.

Fred Bowery, Rep. American Nut and Bolt Fastener Company, Frick Bldg., City.

D. W. Smith, Fore. Painter, Pennsylvania Lines West, Allegheny, Pa.

President: When these names have been submitted to and approved by the Executive Committee, the gentlemen will become members of this Club.

President: Our meeting will necessarily be a little out of the ordinary this evening. Will transact a little business, will have some music, and in fact it is going to be a little bit mixed all around.

Secretary Conway read the following communication:

Syracuse, N. Y., May 18, 1903.

Mr. J. D. Conway, Secretary,
Railway Club of Pittsburgh,
Pittsburgh, Pa.

Dear Sir:—

As I have left Pittsburgh, and do not expect to return as a permanent resident, I believe it is proper for me to tender my resignation as a member of the Executive Committee of the Railway Club of Pittsburgh, in order to enable some other member, who will give it his time and attention better than I can at a distance, an opportunity to serve in this matter.

I, of course, hope to retain my membership, and at a distance will assist the Club in every way possible, and hope occasionally to attend some of its meetings.

With best wishes, I am, yours truly,

JAS. E. SIMONS.

President: Gentlemen, what is your pleasure with the communication of Mr. Simons? At the present time three members of the Executive Committee are not residents of Pittsburgh. Mr. Crawford resides in Ft. Wayne, Mr. Simons is now a resident of Syracuse, and Mr. Hyndman is a resident of DuBois. It is absolutely necessary, it seems to me, that we should have an Executive Committee at least the majority of whom reside in Pittsburgh.

Mr. L. H. Turner: I move that the resignation be accepted, and a vote of thanks tendered Mr. Simons for his past very efficient services to this Club: also that the matter of election to fill the vacancy be postponed until the annual election.

The motion being duly seconded, carried.

President: I understand, gentlemen, that there will be no paper presented this evening, as the Secretary was very much disappointed by the failure of the gentleman who had agreed to get out the paper for this meeting, and it was deemed advisable to have the meeting of a social nature. The Secretary also suggested that in view of the fact that this was the last meeting before our summer vacation, that it might be proper for the President to have something to say.

About seven years ago in Omaha they had a Chautauqua Association, and the subject for that meeting was "The Progress in America in the last One Hundred Years." The President of the Club called upon me to read something along that line, and to please him, I put in a little time on a paper on "American Inventions in the Last Hundred Years from a Mechanical Standpoint." I have a copy of this paper with me, and there may be some things in it that will interest you.

NOTE. (The paper following has been revised to date. —Secretary.)

American Inventions in the Last Hundred Years.

By President J. H. McConnell.

When we investigate the growth in the nineteenth century from a mechanical standpoint, the first to attract our attention is Fulton's steamboat on the Hudson river. In the year 1807 the Clermont was completed and made the first trip on Friday, August 4th, from New York to Albany in thirty-six hours. The return trip was made in thirty hours.

While Robert Fulton was not the first man to construct a steamboat, he was the first man to make a success of the steamboat, as other attempts previous to 1807 were failures. The Clermont, after the first trip, was established as a regular passenger boat between New York and Albany. During the winter of 1808 she was enlarged and in the following spring began running again as a regular boat. In 1812 Fulton built two steam ferryboats for crossing the Hudson river and one for the East River. In 1814 Fulton proposed plans for a war vessel to be propelled by steam. Congress passed an act the same year authorizing the building of one or more floating batteries for coast defense. Fulton was appointed engineer for the construction of the first vessel. In June, 1814, the keel was laid, and in October the boat was launched. By May, 1815, her engine was put aboard. July 4, 1815, the first steam man-of-war ever built made the trial trip to the ocean and back, a distance of fifty-three miles in eight hours and twenty minutes by the force of steam.

In September the complete armament was placed aboard and another trip was made to the ocean and back, the vessel going at the rate of five and one-half miles per hour. The vessel was named the Fulton, the first. In 1811 Fulton built the steamboat Orleans. The first trip was made to New Orleans in 1812; time fourteen days. He also built at Pittsburgh in 1814 a steamboat called the Vesuvius. While Fulton was rebuilding the Clermont, John Stevens was building the Phoenix in New Jersey. It was completed shortly after the

Clermont commenced her regular trips. Fulton having been granted a monopoly of steam navigation on the Hudson, the Phoenix could not run on that river. Stevens, however, was bold enough to take his vessel out to sea in order that it might be put in service on the Delaware river, and John Stevens was the first man to navigate the ocean by steam. The first trip across the ocean by steam was made by the Savannah in 1819 from Savannah, Ga., to Russia by way of England. She returned direct from St. Petersburg, Russia, to New York in twenty-six days.

A Race on the Hudson.

In 1809 a company was formed in Albany as an opposition steamboat line to Fulton's boat, and in September the first vessel was advertised to leave at the same time as Fulton's. Excitement ran high. Both vessels left Albany together, each captain determined on reaching New York first. For a long distance the contest was even, and it was not until New York was almost reached that Fulton's proved itself to be the faster boat. On board the Clermont was Prof. Kemp of Columbia College and, as it left the other behind after thirty hours' struggle, the professor held out a coil of rope to Captain Stout, offering to tow him into port. As new boats were placed in service on the Hudson the speed was increased. In 1820 the time was reduced between New York and Albany to twenty hours; in 1825 to fourteen hours and thirty minutes; in 1870 seven hours. The Daniel Drew, in 1860, on the Hudson river made twenty-two miles an hour against the tide.

Previous to 1815 it required four months to make the trip on a flatboat from New Orleans to St. Louis. The steamer Enterprise, built in 1815, made the trip from New Orleans to Louisville in twenty-five days, two hours and forty minutes; in 1819 the steamer Paragon made the run in eighteen days and ten hours; in 1834 the Tuscorrora, in seven days, sixteen hours; in 1840 the Ed. Shippen in five days, fourteen hours, and in 1853, Eclipse in four days, nine hours and twenty minutes. In 1844 the J. M. White made the run from New Orleans to St. Louis, a distance of 1,218 miles, in three days, twenty-three hours and nine minutes. This was not equaled until the famous race in 1870 between the R. E. Lee and the Natchez, when the former boat made the run in three days, eighteen hours and fourteen minutes, beating the Natchez by six hours.

The First Telegraph Line.

In the year 1832, while returning from a voyage to England, Prof. Morse conceived the idea of electric telegraph. After a great many experiments and discouragements in New York in 1835 he put in operation his first model. The matter was brought before the public in 1837, when he secured his patent. In 1838 a bill was introduced in Congress to appropriate $30,000 to construct a telegraph line between Baltimore and Washington. The proposition was looked upon as wild and visionary, and was ridiculed by the American people. After some delay the bill passed and the line was completed in May, 1844, when the first message was sent a few days later. May 27, 1844, a message was sent from Baltimore to Washington saying:

"James K. Polk has been nominated for President by the Democratic convention in session."

An evening paper published the dispatch, and it was everywhere ridiculed. When the morning train from Baltimore brought the confirmation of the message, Morse's triumph and fortune were assured.

High-Speed Engines.

The improvement in the stationary engine in the United States was not very marked until about 1850. Engines were not constructed with any particular view to fuel economy. Some were running, consuming twice the quantity of fuel necessary to do the work. The Corlis engine, invented by George H. Corlis, of Providence, R. I., created a revolution in stationary engine building, and it has been extensively copied all over Europe.

When the first Corlis engines were built Mr. Corlis offered the proprietors of the James Mills at Newburyport to replace their engines with Corlis engines and take for his pay

$10,000 in cash, or five times the price of the fuel his engines saved in one year over those in operation, they being considered very economical on fuel; 10,483 pounds of coal per day was the average amount used for five years. It was decided to accept the proposition on the fuel-saving basis. The new Corlis engines ran one year from December 3, 1855, and it was found that the average amount of fuel used per day was 5,690 pounds. The coal being reckoned at $6 per ton, Mr. Corlis received for his engines $19,734.22.

In 1852 Mr. Corlis contracted with Crocker Bros., of Taunton, Mass., to furnish them with an engine to do the same work with two tons of coal per day that they were doing with five tons, and agreed to pay them $1 per pound for every pound of coal his engine consumed over two tons per day. His contract was successfully carried out. The introduction of the electric light has produced a large number of what are termed high-speed engines, particularly adapted to fast-running machinery. By their use a small engine running at a high rate of speed is made to develop the same power as a much larger engine running at a slow speed.

The high-speed engine runs at a rate of from 300 to 350 revolutions per minute, while old type of engines ran from 60 to 90 revolutions per minute. The immense amount of power required in large manufacturing establishments and the large ocean steamers has brought out the compound and triple expansion engines. The compound engine has one high and one low pressure cylinder. After the steam has done its work in the high pressure cylinder it enters the low pressure cylinder and performs the same work there, making use of the same steam twice. In the triple expansion engine the same steam is made to do the work for all three cylinders, they being constructed of increased diameters; as the steam loses its force the increased diameter of the next cylinder makes up for the loss in pressure. On steamers having compound or triple expansion engines, the exhaust steam is condensed to water again and the water is pumped back into the boiler. The Corlis engine differed from other engines, particularly in the manner in which its speed was regulated. In the old engines the ordinary flat slide valve was used. In the Corlis engines the valves were circular and made to oscillate in place of sliding. The construction of the governor on the Corlis engine absolutely controlled the amount of steam admitted to the cylinder. If the load was light a smaller quantity was admitted; if the work was suddenly increased by the starting of additional machinery the governor immediately responded and admitted a larger quantity of steam to take the increased load, giving the engine at all times a steady and uniform motion.

Printing Press Evolution.

The printing press has shown remarkable development since 1860. In 1835 the New York Tribune had a printing press capable of printing 1,500 copies an hour and three men working from midnight until 6 in the morning could turn out the whole edition. After a long season of experimenting the stereotyping process was applied to newspaper work. In 1861 W. M. Bullock of Pittsburgh built the first web press, but it was several years before he produced the improved press capable of turning out 10,000 perfect copies an hour. In 1871 Richard M. Hoe produced a press which turned out 18,000 papers per hour. He soon brought out another press called the double perfecting press, which turned out 30,000 papers per hour. His next improvement was a press turning out 48,000 eight-page papers per hour. This work is done night after night, always producing the same results? This machine folds and automatically counts them in bundles of fifty each.

The latest machine from the Hoe Company is a press that prints, pastes, folds and counts at the rate of 96,000 four-page papers an hour, 48,000 six or eight-page papers and 24,000 ten to sixteen-page papers per hour. In the art of printing the new typemaking and setting machine is considered a marvel. By its use the melted metal is run into a type machine set up and ready for the column before leaving the machine. The New York Tribune has a man at one of these machines who has made and set up 80,000 "ems" in one day. An ordinary day's work on one of these machines is 48,000, made and set up ready for the press. The type is not used a second time and after being used once is not distributed in the ordinary way, but is melted up and used over.

To America belongs the credit of the first successful sewing machine. Elias Howe, employed in a machine shop at Boston, conceived the idea of making a sewing machine. For five years he planned and worked at it. In 1845 his first model was made and in 1846 he secured a patent to use it. In 1847 he took the machine to England were he tried to introduce it, without success. On returning to Boston he found parties had constructed machines after his patent. After numerous law suits he secured his rights in the invention. At the expiration of his patent his invention had netted him $2,000,000.

Advent of the Railroad.

The railroad industries of the United States date from 1826, when the first railroad, two miles long, was built at Quincey, Mass. It was operated by Horses. Originally the rails were made of wood. Afterward they were covered with an iron plate. The introduction of locomotives met with a great deal of opposition and the suggestion that they would eventually pull a train of cars 12 miles an hour was considered the talk of a crazy man. From 1826 to 1840 only 2,197 miles of railroad had been built. In 1870, 48,000 miles were in operation and in 1902, 200,000 miles. The present mileage of the United States is nearly one-half of the total mileage of the world, being 45 per cent. The Interstate Commerce report, 1901, says: "There are $11,688,147,091 invested in the railways of the United States. No other enterprise has grown so rapidly. The total earnings for the year ended June, 1901, were $1,588,526,037, divided as follows: Passenger earnings, $351,356,265; freight earnings, $1,118,543,014; the balance about $118,600,000, represented the earnings for mail, express and miscellaneous service. The number of passengers carried was 607,278,121; tons carried, 1,089,226,440. This service required 1,100,000 employes whose wages amount to $610,000,000, 1,600,000 freight cars, 36,000 passenger cars and 40,000 locomotives, also 4,000 sleeping cars. Ten thousand two hundred locomotives were engaged in passenger service, 23,000 in freight service, 6,000 in switching service and 800 in miscellaneous service.

The growth of the locomotive and freight car is an interesting study. The first locomotive weighed about four tons, and it did not increase much above twenty tons until after 1850. From 1850 to 1870 there was a marked increase in the size and weight. Engines were built in 1870 weighing sixty tons. In 1890 a number were built weighing eighty tons, without tender; in 1902 a number weighing 130 tons and with tender loaded 70 tons, a total of 400,000 pounds. The first locomotive with tender did not weigh to exceed seven tons.

Previous to 1850 the ordinary freight car weighed five tons and carried a load of five tons. The modern freight car weighs 35,000 pounds, and carries a load of 80,000 pounds. The former car and load weighed 20,000 pounds, while the modern car weighs 105,000 pounds. Steel coal cars now in general use carry 100,000 pounds of coal.

Since 1870 transportation of fruit, vegetables, dressed beef and other perishable goods has brought the refrigerator car into use. It has insured the successful transportation of fruit from California to New York. Meat can be carried with safety long distances.

The furniture car is of recent date. Some of these cars are fifty feet long and are used for the transportation of furniture, wagons, agricultural implements and articles of large bulk and light weight. The transportation of oil in bulk now requires a tank car holding 8,000 gallons. Special stock cars for cattle and horses are now in common use. All of these special features have increased the cost. The increase in size and capacity of the modern equipment has been occasioned by competition, decrease in rate and in the transportation of perishable freight, which could not be transported long distance until these cars were provided. The refrigerator car has concentrated the packing houses in a few large cities. The passenger car equipment has increased in size, weight and magnificence in the last twenty-five years. Previous to 1860 there were not many sleeping cars in service. After their introduction the public demand required their adoption on all trunk lines. When first introduced they weighed 60,000 pounds. This weight has been increased to 120,000 pounds. Originally they cost $12,000, and a number are in service to-day, costing $28,000. A modern passenger car or sleeping car has gas light, steam heat, hot and cold water, and are a perfect palace compared with cars twenty-five years ago. With better equipment the speed has been increased. In 1870 twenty-two miles an hour was the average speed of a passenger train. It required six days and twelve hours to go from New York to San Francisco. The trip is now made in about four days; three days from Chicago to San Francisco and one day from New York to Chicago. In 1870 the journey from Omaha to Ogden required fifty-two hours; it is now made in thirty hours. With increased speed and comfort the public gets cheaper fare and still they want it for less.

The first American locomotive was built at the West Point foundry in 1830. After running a short time it blew up and another was built by the same company. In January, 1831, the Baltimore & Ohio Railroad offered $4,000 for the best anthracite coal-burning locomotive, weighing three and a half tons, capable of drawing fifteen tons, fifteen miles an hour on a level. In January, 1833, M. W. Baldwin, of Philadelphia, built the old Ironside. This engine weighed five tons.

American Locomotives the Best.

In 1833 Richard Norris of Philadelphia built a locomotive that hauled 19,200 pounds up a grade 369 feet to a mile. The engine weighed seven tons. The performance of this engine attracted attention in England. Several of this class were ordered and sent over, where they performed very successfully. As the railroads increased the locomotive factories increased. The locomotive works of the United States have a capacity of 4,500 locomotives per year. The American locomotive is superior to any built in the world and is a distinct type.

There is a similarity in all the European engines, nearly all are copied from English manufacturers. Previous to 1870 a large portion of the locomotives in service in the United States were thirty-ton engines. The increase in the size and weight of trains has resulted in engines for freight service weighing from one hundred to one hundred and thirty tons, while the increased speed demanded for passenger trains requires eighty and ninety-ton engines.

The limited trains between New York and Chicago, making about 1,000 miles in twenty-four hours, are no longer considered fast. The Empire State Express between New York and Buffalo runs at the rate of fifty-two miles per hour, including stops. On short runs a speed of 112 miles an hour has been attained. From 1861 to 1868 there was a great demand for locomotives. As high as $26,000 was paid for the same kind of locomotives that can be purchased now for $10,000. The introduction of steel rails in place of iron commenced about 1860. They cost $120 per ton and were imported from England. When the manufacture of steel rails commenced under the protective tariff in the United States, the price declined. During the year of 1895 steel rails were sold in the United States for $20 per ton.

Miles and Miles of Cars.

The weight of a rail is given as so much per yard. A seventy-pound rail means seventy pounds per yard. Rails are thirty feet in length. Some years ago twenty-six feet was the length, but now thirty feet is the standard. A few sixty-foot rails are used by some of the railroads. In the last twenty years the increase in the weight of engines and cars has been made necessary to entirely replace all the bridges and rails on all trunk lines of the United States; in fact there is practically nothing left of the railroad of twenty years ago. Engines, cars, bridges, rails and ties have all been replaced with new. As the ties last about five years, they have been replaced four times.

The Westinghouse airbrake is one of the important inventions of the last thirty years. It is now in use on railroads in all parts of the world. Its application to passenger trains commenced in 1869. For five years it advanced slowly. Railroad companies were disposed to be conservative adopting it. After 1875 it was rapidly applied to all passenger equipments. By the use of it on passenger cars the increased safety in handling trains led to its application to freight cars.

Increased speed of all trains brought out the brake applied to the driving wheels of the locomotive, and the high-speed brake for passenger trains.

It was not until 1850 that horse cars were used in the United States. After their success was established here they were adopted in England. The first English street car line was built at Berkenhead, England, in 1860 by George Francis Train. In 1869 horse cars were introduced in Liverpool. In 1873 the first cable street railway in the world was put in operation on Clay street, San Francisco. It was built by A. S. Hallidie. His friend refused to assist him, as the enterprise was looked upon with derision and considered visionary.

Notwithstanding the opposition, the line was completed and put in operation in August to the surprise of everybody but Mr. Hallidie. It was a success. After three years' service other lines were established in San Francisco. In 1879 Robert Gillham, of Kansas City, turned his attention to the practicability of a cable line for that city, but met with marked opposition from the people there. Receiving the money and influence of eastern capitalists he built the first cable line, and put it in operation in Kansas City in 1885. It was considered that while it might do for a country where there was no winter, it would be impossible to operate it in the winter time, as frost and snow would prevent its operation.

Kansas City and Chicago demonstrated to the world that a cable line could be operated successfully in winter weather. The cable system was finally adopted in England in 1883. The rapid increase of electricity applied to street car service displaced 145,000 horses in five years.

The first successful steam fire engine was built at Cincinnati in 1852 and tested before a committee of the city council. At the test, steam was raised from cold water, the engine started, and water discharged from the nozzle to the distance of 130 feet through 350 feet of hose in four minutes and ten seconds from the time smoke was seen to issue from the stack. The city council contracted for an engine of the same character. When delivered it was placed in charge of a company organized and paid by the city. This is the first record of any paid fire department in the world.

In the year of 1837, in Connecticut, the first clock with a brass movement was manufactured. It ran thirty hours. The first brass eight-day clock was not manufactured until after 1841, when all parts of the clock were made by machinery. In 1853 and 1854, 880,000 clocks were manufactured each year. The Yankee clock is sold all over the world. The first watch made in the world, entirely by machinery, was made at Roxbury, Mass., in 1853. The parties forming the first company were A. L. Denison, E. Howard, D. P. Davis and Samuel Curtis. The location at Roxbury was unfortunate on account of the fine dust from the clay soil. The company afterward built an extensive plant at Waltham, Mass., called the American Watch Company. It turned out annually 80,000 watches.

A machine for the manufacture of solid headpins was invented by L. W. Wright of Massachusetts. He carried it to England, and in 1833 the first solid headpins were sold.

In 1840 John J. Howe patented another machine for making pins. In 1846 a number of pin machines were invented. Few succeeded in doing good work. There is a firm in Waterbury, Conn., having an improved machine for making pins that turns out 8,000,000 pins each day. The wire is run into the machine from a reel, cut to the right length, headed, pointed and dropped into the hopper of the sticking machine. This machine arranges them and sticks them in papers, and they come out ready for the market, and we wonder what becomes of all the pins.

Here the Reaper Came in.

In 1834, Cyrus H. McCormick obtained a patent for his reaper. No machines were made for sale before 1840, as he found it needed a number of improvements. For six years he worked at the machine, improving it after each harvest, each one built by himself in his father's blacksmith shop at Walnut Grove, Va—when he was finally able to build one machine per week. In 1844 the first consignment was shipped to Cincinnati, where a factory was started the same year. In 1846 he moved to Chicago. In 1855, in a trial of American reapers against the world, near Paris, three machines were entered, one American, one English, and one Algiers, each machine to cut and rake one acre of oats. The American machine did its work in twenty-two minutes, the English in sixty-six minutes and the Algerian in seventy-two minutes. At a subsequent trial of three other machines of English, French and American manufacture, the American machine cut its acre in twenty-two minutes, while the other failed. The contest was finally narrowed down to three machines all of American manufacture. Each performed the work to the astonishment and satisfaction of the judges. In 1867 at the Paris exposition, in a field trial, the McCormick reaper defeated all competitors and demonstrated on two occasions the superiority of the American reaper against the world.

The Bell telephone was patented May 8, 1876, and was first exhibited at the Centennial in Philadelphia by the inventor, Alexander Graham Bell. At first it was considered a toy and the American people did not take to it. In 1877 Bell took it to England and could not dispose of one-half the European right for $10,000. March 1, 1880, but 183 telephones were in use in the United States. Three years later 890 were in use.

C. L. Sholes, of Wisconsin, is the inventor of the present typewriter.

B. B. Hotchkiss, of Connecticut, invented the breech-loading cannon. Meeting no success in the United States he took it to Europe, where it met with favor and made him a fortune.

The gimlet pointed screw was invented by Thomas W. Harvey, of Providence, R. I., in 1838.

Thomas Blanchard, of Massachusetts, invented the lathe for turning irregular shapes, such as gun stocks, wagon spokes, shoe lasts, hat blocks, ax handles and many other irregular forms. After working six years he invented and patented a machine that made 500 tacks per minute.

The Age of Electricity.

In 1875 Charles F. Brush, of Cleveland, O., patented a dynamo which made the present system of arc light successful. He also improved the arc lamp, making the Brush arc light the first successful one in the country.

The present incandescent electric light is the result of the labor of Thomas A. Edison, who worked and experimented for several years before he produced the present lamp. The phonograph is another of his inventions. He also constructed an electric locomotive.

Since 1880 electricity has been applied to a great variety of work formerly done by steam power. Some mines are operated entirely by it, furnishing power for hoisting, lighting, running pumping machinery and drills. Shops are operated by motors in place of steam engines. It is successfully used for heating and cooking. The expense of the cooking apparatus so far has prevented its general use. The storage battery is used to propel boats, automobiles and lighting cars. The Manhattan and Brooklyn railway now operates trains by electricity in place of steam. This system has also been adopted on the elevated roads in Chicago. A number of electric locomotives have been put in service in the last ten years in the operation of mines and in yards around large manufacturing concerns. The latest in this line is an electric locomotive weighing 160 tons, capable of hauling 1,500 tons up a 75-foot grade.

A recent newspaper article gives interesting information about electric street car service as follows:

On the Albany and Hudson line it is possible to travel at sixty miles an hour. There are two electric lines in Indiana that work up to fifty-five miles an hour each, and two more that make forty. Ohio has ten electric roads whose cars reach or exceed forty miles an hour; two of them make fifty and two fifty-five. Michigan has one trolley line on the forty-mile speed limit, two at forty-five and two at fifty. There is a fifty-mile-an-hour line in Iowa, another in New York, and another in Texas. Speeds of from thirty to forty miles are too common to mention.

The electric roads of the United States carried last year three times the population of the earth. They ran their cars eleven times the distance from the earth to the sun. They killed 1,218 persons and wounded 47,429, which makes the war with Spain look like the Fourth of July at the Waldorf-Astoria. Their capital was more than twice as great as the bonded national debt of the United States, and their gross earnings for the year were nearly a quarter of a billion dollars. They employed more than twice the number of men in the United States army including the force in the Philippines. They paid over thirteen million dollars in taxes—a little consolation prize to the public for the franchises they got for nothing.

The construction of the electric power plant at Niagara Falls will eventually make Buffalo a great manufacturing city. When we see what has been accomplished by electricity in the last fifteen years we look with interest and anxiety to the future to know what is in store for us.

Following the reading of the paper by the President, the following entertainment was carried out:

Piano Solo, Selected—
Professor Eccleson.

Banjo and Guitar Selection—
By Professors Stinson and Black.

Song, "My Own United States"—
Professor Blaney.

Banjo and Guitar Selection—
Stinson & Black.

Encore—Song, "Rag Time Joe"—
Professor Stinson.

"Two Baseball Stories"—
By Professor Blaney.

Piano Solo—
Professor Eccleson.

Story, Religious—
President McConnell.

Specialties—
By Master Earl Lindsay.

Song, "Down Where the Wurtzburger Flows"—
Professor Blaney.

Encore, "I Would be Satisfied With Life If—
Monologue—
By Professor F. H. Blaney.

W. L. Shafer, Railroad Editor of the Pittsburgh Post, being called upon, responded with two of James Whitcomb Riley's best selections.

Banjo and Guitar, "Sprays of the Ocean"—
Professors Stinson and Black.

President: The next part of the program is a lunch party, to which all are cordially invited.

The members then retired to the dining room, where a delightful luncheon was served.

Following luncheon, Club adjourned.

EDWARD KERR, President. W. R. BROWN, Supt. G. W. GOSSER, Sec'y and Treas.

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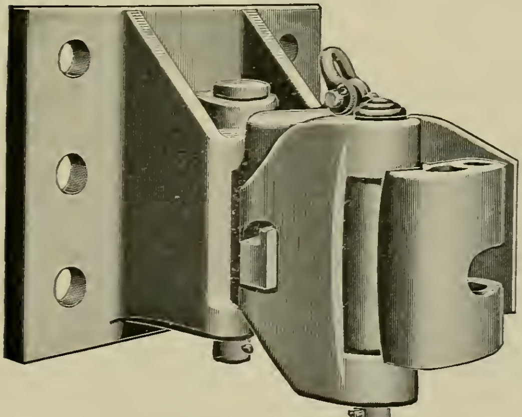

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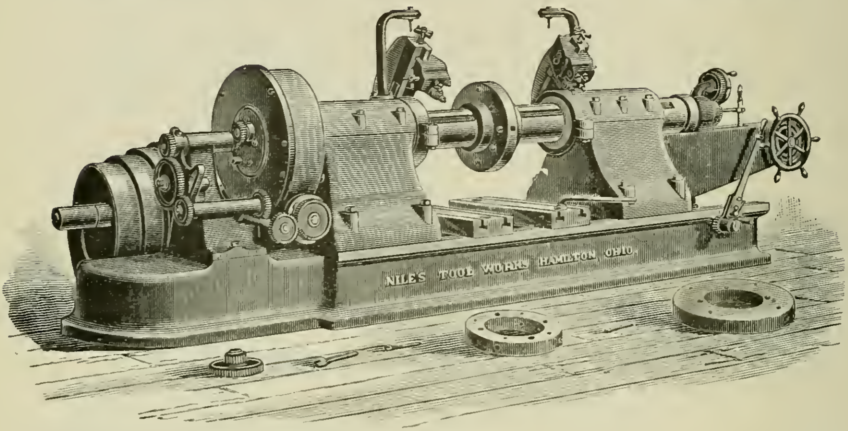
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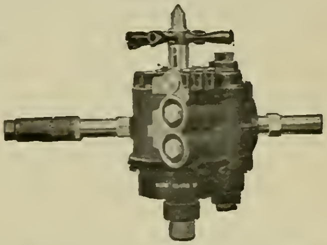

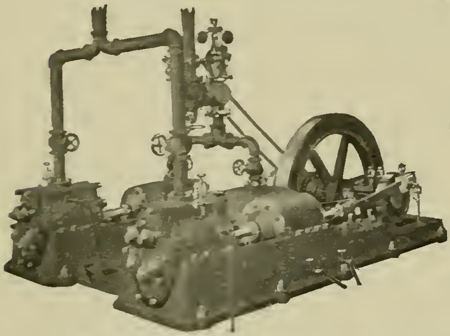

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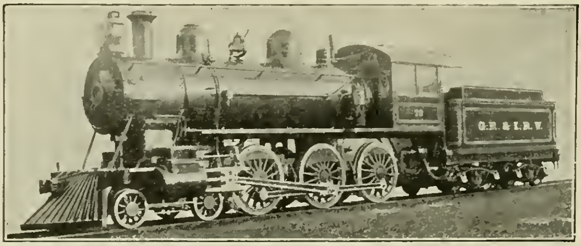

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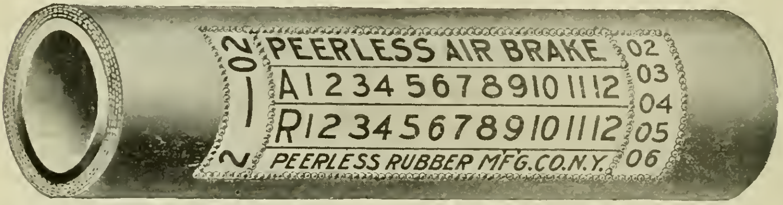
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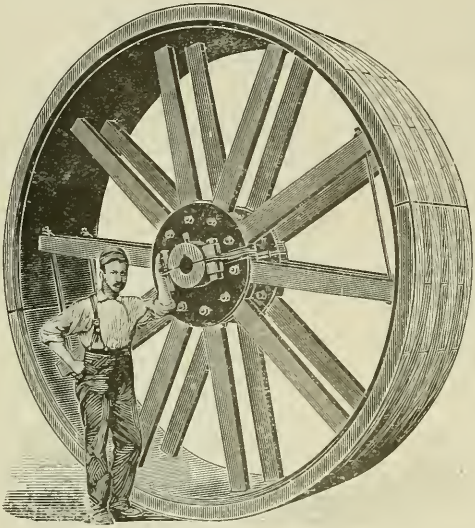

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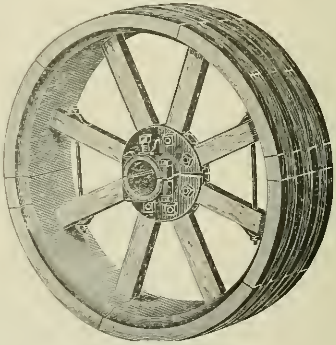

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Du Bois, Pa.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
SEPTEMBER 25, 1903.

The meeting was called to order at 8.00 o'clock P. M., at the Hotel Henry, Pittsburgh, Pa. In the absence of President J. H. McConnell, Vice President L. H. Turner presided.

The following gentlemen registered:

MEMBERS.

Anderson, H. T.
Berkebile, R. L.
Blackall, R. H.
Blest, M. C.
Brown, Jno. T.
Carson, G. E.
Conway, J. D.
Courson, J. F.
Courtney, D. C.
Dow, G. N.
Fitzgerald, Orrin.
Grove, E. M.
Hall, W. G.
Harris, J. D.
Holbrook, D. O.
Hunter, H. S.
Jenny, Jacob.
Kearney, A.
Kelly, Moore.
Kessler, D. D.
Lee, Louis A.
Macoubray, R. J.
Malloy, M. A.
Milligan, J. D., M. D.
Milliken, I. H.
Miner, W. H.
McCaslin, A. W.
McIlwain, J. D.
Noble, D. C.
Oates, Geo. M.
Obey, G. B.
Partington, Jas.
Proven, Jno.
Quest, W. O.
Redding, D. J.
Richardson, W. P.
Scheck, H. G.
Shannon, W. N.
Squire, Willis C.
Stark, B. F.
Strattan, G. W.
Stucki, A.
Summers, E. W.
Synnestvedt, Paul.
Tesseyman, J. E.
Tucker, Jno. L.
Turner, L. H.
Turner, J. S.
Warne, J. C.
Whinery, S. B.
Wright, Wm.
Wright, R. V.
Wynn, B. F.

VISITORS.

Chambers, Walt. F.
Hood, Chas.
Hughan, James.
Keithley, J. T.
Koontz, Louis K.
Moyer, F. H.
Suler, D. H.
Whitehill, Buell B.

The minutes of previous meeting being printed, the reading of them was dispensed with.

Secretary Conway read the list of names of applicants for membership, as follows:

C. S. Johnson, President Monongahela Foundry & Forge Co., Monongahela City, Pa.

F. Hughes Moyer, Mechanical Engineer, Office of E. W. Summers, Farmers Bank Building, Pittsburgh, Pa.

J. D. Smith, President J. D. Smith Foundry Co., Cleveland, O.

E. P. Watrous, Manager The Garlock Packing Co., 114 Wood street, Pittsburgh, Pa.

Chas. Y. Hood, Consulting Engineer, Hood Automatic Window Co., 706 Wood street, Wilkinsburg, Pa.

C. T. Schoen, President Schoen Steel Wheel Co., Pittsburgh, Pa.

M. R. Jackson, Manager Schoen Steel Wheel Co., McKees Rocks, Pa.

H. P. Clark, Superintendent Mechanical Department, Pittsburgh Railways Co., Pittsburgh.

H. D. V. Porter, Assistant Purchasing Agent, Union Railroad Co., Pittsburgh, Pa.

C. R. Miller, Assistant Purchasing Agent, Carnegie Steel Co., Carnegie Building, Pittsburgh.

J. B. Gibb, Manager, Railway Steel Spring Co., Twenty-first street and Liberty avenue, Pittsburgh.

M. McDaniel, Master Plumber, P. R. R. Co., 5739 Baum street, Pittsburgh, Pa.

Chas. Gulland, Assistant Master Plumber, P. R. R. Co., 7941 Maderia street, Pittsburgh.

H. M. Meason, Round House Foreman, P. R. R. Co., Pitcairn, Pa.

Wm. Hirsh, Sales Agent, American Steel & Wire Co., Pittsburgh, Pa.

President: Gentlemen, after these names have been submitted to the Executive Committee and by them approved, these gentlemen will become members in full standing in this Club.

Secretary Conway made his report of the meeting of the Club Secretaries held at Saratoga in June last, which, upon motion, was ordered filed.

("See minutes of meeting, page 213".)

The President called for the report of the Secretary as to the appointment of committees.

Secretary: Since our last meeting we have lost a member by death, Mr. William H. Bown, who was well known in Pittsburgh and other cities. It would be appropriate, I think, that a committee be appointed this evening to draft suitable resolutions. Mr. Bown died on July 25th, 1903.

A motion was made and seconded, and on vote concurred in, that a committee be appointed to draw up suitable resolutions.

President: The Chair will appoint as a Committee, Robert A. Bole, John T. Brown, and David O. Holbrook.

The President here introduced Mr. Paul Synnestvedt, who read the paper presented by him.

THE NATURE OF A PATENT RIGHT.

BY PAUL SYNNESTVEDT.

Some time ago the writer was accorded the privilege of presenting a paper before the Western Railway Club, in Chicago, entitled "What a Patent is Not," and as the subject matter of that paper seemed to be received with some interest by the members of that club, use will be made of some of the ideas contained in the same in presenting the subject of this paper before the members of this club. The reason for the negative form of the title "What a Patent is Not," lies in the fact that in considering the subject of patent rights, as well as of other things, it is difficult to get a clear comprehension as to what anything *is* without some pretty good idea as to what it, also, is not.

In considering the nature of a patent right, it is next to be noted that the grant of a patent is not made, as is often assumed to be the case, for the sake of the *inventor*, but from the standpoint of public policy, for the sake of the *public good*, in order "to encourage the progress of science and the useful arts," as it is stated in that clause of the Federal Constitution which forms the basis for all our patent statutes. And the wisdom of the framers of our Constitution, in making a provision of this kind, has been fully proven by the experience of over 100 years. during which some patent system has been in force in this country. Wherever inventors have been encouraged in this manner, industry and progress have prospered, and wherever they have not, as for example in certain districts through an unfavorable attitude assumed by some of our courts, industry and progress has been correspondingly discouraged.

That all patentees who hold *valid* patents have benefited the community is obvious, from the fact that in order to sustain the validity of any patent it must, amongst other tests, stand the test of novelty and utility; that is, it must be estsblished that the invention is *new*, and adds something in the nature of improvement of a *useful* character to the arts as the state of the same existed before the creation of the invention. If a patent grant took from the public the right in any thing of a determinative or definite character, or a right in any property formerly possessed by the public, it would be inconsistent with the spirit of our age and obnoxious to people of all classes, as was, in fact, the case with some of the older statutes and special privileges which existed for several centuries past in England at different times.

In the words of Bentham, in his Rationale of Reward, a patent "is an instance of a reward peculiarly adapted to the nature of the service, and adapts itself with the utmost nicety to those rules of proportion to which it is most difficult for reward, It is the writer's observation that of all the common mistakes chargable to those not posted in patent matters, the mistake which is most frequently encountered by the patent practitioner is the supposition that seems to be held, on the part of many, that the grant of a patent to an inventor conveys in some manner the right to the use of his invention. The fact of the matter is that no right of this kind is conveyed by U. S. Letters Patent, but only the right to *exclude others* from using the invention which forms the subject matter of the patent; in other words, the right of *exclusion* for a limited time, whereby a monopoly may be created which may bring to the patentee some return for the labor involved in the development of his invention.

The patent system, as we know it now in this country, is altogether on these lines: The Government, in the grant of a patent, undertakes to protect the patentee for a period of 17 years in the right to exclude every one else from making, using and selling his invention, save only on consent of the patentee. Before the grant of any patent every inventor has the right to make, use and sell his invention, assuming that such manufacture, use or sale does not infringe any other pre-existing right, but until a patent is granted every one else has a like right and hence what the patentee actually gets is the right to take away from every one else the liberty of following in the patentee's footsteps with respect to such manufacture, use or sale of the invention.

It is a peculiar incident to this grant, that unless the public at large is given the benefit of the invention by commercial introduction of the same, no benefit, financially, accrues to the owner of the patent. This is obvious from the fact that the only recompense in a financial way which a patent owner gets comes, ultimately, either from royalties or from profits arising out of the manufacture, use or sale of the patented improvement, and, as intimated, unless some commercial operation is carried out, of course no royalties are collectible, nor are any profits made.

artificially instituted by the legislature, to confer. If confined, as it ought to be, to the precise point in which the originality of the invention consists, it is conferred with the least possible waste of expense. It causes a service to be rendered, which without it, a man would not have a motive for rendering; and that only by forbidding others from doing that which, were it not for that service, it would not have been possible for them to have done. Even with regard to such inventions, for such there will be, where others besides him who possesses the reward have scent of the invention, it is still of use by stimulating all parties and setting them to strive which shall first bring the discovery to bear. With all this it unites every property that can be wished for in a reward. It is variable, equable, commensurable, characteristic, exemplary, frugal, promotive of perseverance, subservient to compensation, popular and reasonable ''

That the patent system is distinguished by having an origin of reasonable antiquity is evident from the fact that we find that in the reign of Edward III, on representation to him of the feasibility of making a ''philosopher's stone,'' that monarch issued a commission of two friars and two aldermen to inquire into the matter, and, on their reporting in its favor, granted to them and their assigns the *sole* privilege of making the philosopher's stone.''

Nearly all of the earliest forms of such grants in England, dating several centuries back, were of similar characteristics to those of our present patent grant, but the special privileges of those early days were by degrees perverted from their primary purpose, and, under the pretense of a better government of trade, the prerogative of the Crown was employed in return for pecuniary considerations in sanctioning certain individuals and corporations in the practice of various oppressive monopolies. The evil of this grew until in the reign of Elizabeth, large numbers of the necessaries of life were controlled by such monopolistic patentees.

Thus, at one time, there were included in such oppressive special grants the exclusive rights of trade in salt, iron, powder, vinegar, paper, starch, tin, sulphur, and a multitude of others.

When a list of them was read in the House of Commons a great disturbance was raised, one member crying: "Is not bread in the number? If affairs go on at this rate we shall have bread reduced to a monopoly before next Parliament."

The monopolists were so exorbitant in their demands that they raised the price of salt from 16 pence a bushel to 14 or 15 shillings. Such high profits naturally began to attract intruders upon their commerce, so that in order to secure themselves against encroachment the patentees were armed with high and arbitrary powers by the councils, by which they were able to oppress the people at pleasure, and to exact money from such as they thought proper to accuse of interfering with their patent. (See Coryton on Patents, ed. of 1855, p. 28.)

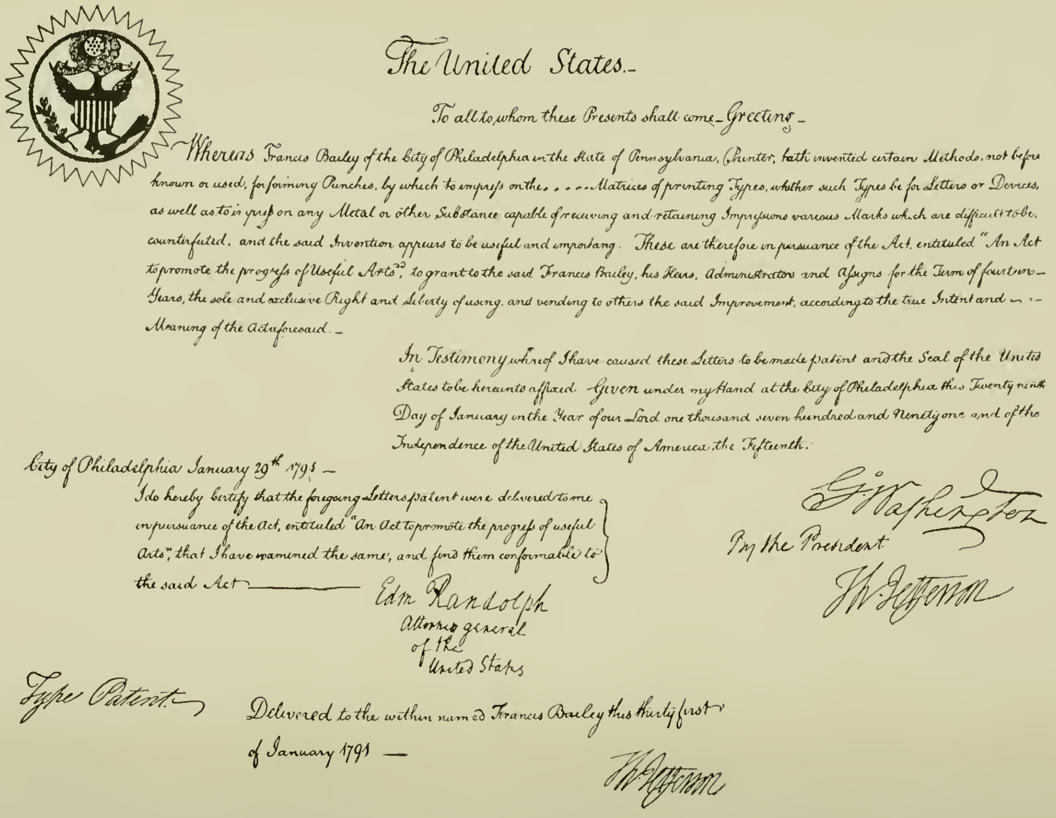
Thus the patentees of saltpetre were granted the power of entering every house, "and of committing what havoc they pleased, in stables, cellars, or wheresoever they suspected saltpetre might be gathered, and they commonly extorted money from those who desired to free themselves from this damage or trouble; and while all domestic intercourse was thus restrained, lest any scope should remain for industry, almost every species of foreign commerce was confined to exclusive companies, who bought and sold at any price they themselves thought proper to offer or exact." (Coryton on Patents, p. 28.)

"Even Elizabeth's House of Commons rang with angry complaints. On the 20th November, 1601, a great debate upon the subject took place, on an attempt by Lawrence Hyde to introduce 'A Bill for the Explanation of the Common Law in certain Cases of Letters Patent.' After much discussion as to whether the proceedings should be by bill or by petition to Her Majesty, but before anything was concluded upon the Queen sent a message to the House importing that the monopolies should be revoked."

In excusing the objectionable grants. the Queen, in a message to the Commons, said: "Since I was Queen, yet never did I put my pen to any grant but upon pretense and semblance made unto me that it was both good and beneficial to the subjects in general, though a private profit to some of my ancient servants who have deserved well, but the contrary being found by experience, I am exceedingly beholden to such subjects as would move the same at first. That my grants should be grievous to my people, and oppressions to be privileged under color of our patents, our kingly dignity shall not suffer it; yea, when I heard it I could give no rest to my thoughts till I had reformed it."

While subsequently to the events just narrated special grants in restraint of common trade were gradually reduced in number to practically nothing, exclusive privileges in reward of invention have remained, and there is reason to believe that the practice of making grants of the sole use of inventions originated in England, and that the English system of rewarding inventors has since been copied more or less closely by almost every European power. Our own system is based upon it in many respects, although differing greatly in organization and detail, and the characteristics or nature of the grant remain to this day, after centuries of time, substantially the same,—the securing to an inventor, for a limited time, the right to *exclude* others from practicing his invention save on license secured from him, wherefrom he secures his pecuniary reward.

Mr. Paul Synnestvedt: Supplementing that, I want to say that I have here in my hand a reproduction or zinc etching of the first patent issued by the government, and beside it a reproduction or zinc etching of a patent of recent date. I have brought them here this evening particularly to call your attention to the fact that although the first of these grants was dated 1791, and signed by George Washington and Thomas Jefferson, and the other one dated over one hundred years later. the grant is almost exactly the same; and the recital of the terms on which the grant was conditioned is almost the same.



The United States.—

To all to whom these Presents shall come—Greeting—

Whereas Francis Bailey of the City of Philadelphia in the State of Pennsylvania, Printer, hath invented certain Methods, not before known or used, for forming Punches, by which to impreſs on the . . . . Matrices of printing Types, whether such Types be for Letters or Devices, as well as to impreſs on any Metal or other Substance capable of receiving and retaining Impreſsions various Marks which are difficult to be counterfeited, and the said Invention appears to be useful and important. These are therefore in pursuance of the Act, entituled "An Act to promote the progreſs of Useful Arts", to grant to the said Francis Bailey, his Heirs, Administrators and Aſsigns for the Term of fourteen—Years, the sole and exclusive Right and Liberty of using, and vending to others the said Improvement, according to the true Intent and . . Meaning of the Act aforesaid.—

In Testimony whereof I have caused these Letters to be made patent and the Seal of the United States to be hereunto affixed. Given under my Hand at the City of Philadelphia this Twenty ninth Day of January in the Year of our Lord one thousand seven hundred and Ninety one and of the Independence of the United States of America the Fifteenth.

Go: Washington

By the President

Th: Jefferson

City of Philadelphia January 29th 1791—

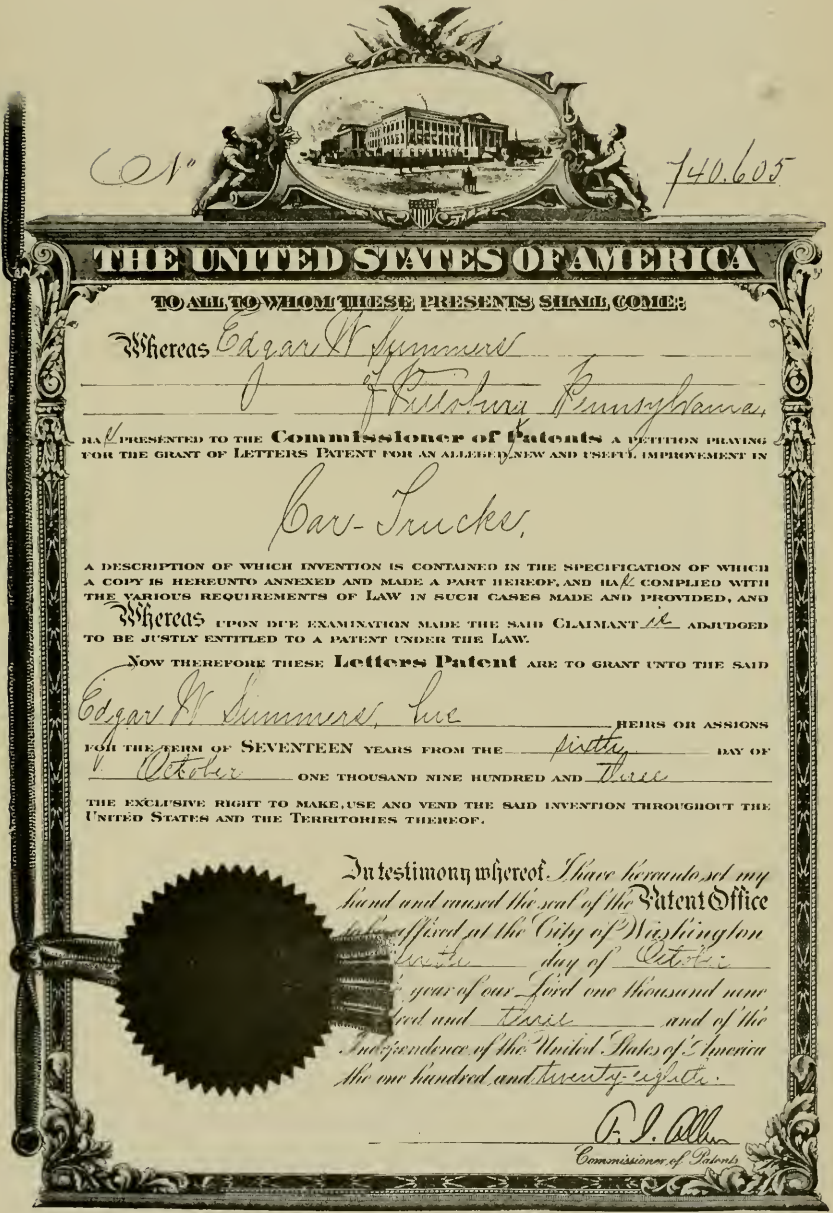
I do hereby certify that the foregoing Letters patent were delivered to me in pursuance of the Act, entituled "An Act to promote the progreſs of useful Arts", that I have examined the same, and find them conformable to the said Act ——— Edm Randolph

Attorney general
of the
United States

Type Patent

Delivered to the within named Francis Bailey this thirty first of January 1791 —

Th: Jefferson



No 740.605

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas Edgar W. Summers, of Pittsburg, Pennsylvania,

has presented to the **Commissioner of Patents** a petition praying for the grant of Letters Patent for an alleged new and useful improvement in

Car-Trucks.

a description of which invention is contained in the specification of which a copy is hereunto annexed and made a part hereof, and has complied with the various requirements of Law in such cases made and provided, and

Whereas upon due examination made the said Claimant is adjudged to be justly entitled to a patent under the Law.

Now therefore these **Letters Patent** are to grant unto the said Edgar W. Summers, his heirs or assigns for the term of SEVENTEEN years from the sixth day of October one thousand nine hundred and three the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office affixed at the City of Washington sixth day of October year of our Lord one thousand nine dred and three and of the Independence of the United States of America the one hundred and twenty-eighth.

F. I. Allen
Commissioner of Patents

Now you will find on reading those two grants, both the modern grant and the first grant, that the terms are somewhat misleading, because they say they grant to the inventor the exclusive right; and you would think that if he had an exclusive right, he also would have a right, but I want to call your attention to the fact that whether he has a right or not depends not on whether he has a patent or not, but on whether or not the patent that he has is an infringement on somebody else's right. The situation is a little difficult to catch at first, but perhaps will be clearer if you look at it in the light of an illustration; as, for example, assume that a man by the name of Smith has a patent on a car coupler, and assume that he was the first man to produce the M. C. B. coupler, and had a claim involving a combination of a coupler-head, a knuckle, and a locking device. Now that, under the patent law, would be an operative combination. And the first man to produce that combination in a machine, after satisfying the requirements of the law, would succeed in getting a patent upon that combination, that Smith coupler, comprising a coupler-head, a knuckle, and a locking-pin.

If Smith was the first man to produce that combination he could sustain that patent almost without regard to how the different elements that entered into it were constructed. Thus, a man by the name of Jones might come along and take Smith's coupler, and make a very superior locking device to go into that combination. Thus you would have a Jones locking device applied to a Smith coupler. Jones could get a patent, under the law, on the improvement of the locking device. He could get a patent reading like this: a combination in a car-coupler of a coupler-head, a knuckle, and a particular form of locking device,—that is, whether it should be a rotating cam, or a pin to pull up, or whatever it was. The Jones patent would be a perfectly good patent under our law, and he would have the right under that grant to prevent Smith, as well as everybody else, from using his particular form of locking device; but he would not be free himself, until the expiration of Smith's patent, or until he got permission by paying a royalty to Smith, to make or sell or use any couplers embodying that improved locking device of his.

Thus, whether an inventor has the right to use his particular invention or not depends on whether or not it is an infringement of some pre-existing right, and something which is absolutely new from the beginning, or whether it is something in the nature of a further improvement on something which has already been patented. And that is a question entirely apart from the question as to whether his patent is valid or not, or as to whether he can get the patent or not; and it is a question that the patent office does not take into account in passing on an application for a patent.

If you file an application in the patent office, the first thing they do is to make an examination to determine whether the particular claim that you make, the particular novel combination that you claim in your application, is shown in some prior publication. They do not pay the slightest attention in that search as to whether after you get the patent on your claim you would be entitled to make the device in conjunction with which it is intended to be applied. That is a question that every patentee and inventor has to have investigated on his own hook, because the issuance of the patent by the patent office is no true guide. Of course it happens incidentally in many cases that in the course of the searching done by the patent office to determine whether the particular combination that the applicant is trying to get a patent on, is new, that they cite or refer to prior patents or publications which will indicate to him what the situation is with reference to his rights to manufacture; in other words, they will say that his claim is rejected because substantially the same thing is shown in a prior patent to Johnson issued in 1888 or 1889, and when he gets the Johnson patent he may find, assuming it to be a live patent, that there is a claim in there which he would infringe if he should go ahead and manufacture.

Now I should like to add that if there are some points in this paper that I can make a little more clear, I shall be very glad to have some one to wade into it and give me an opportunity to illustrate it further.

President: The subject does not seem to admit of much discussion, but it has been presented to us in a very entertaining manner, and Mr. Synnestvedt will be very glad to answer any questions, and I hope the members will keep him busy for about forty minutes. You cannot know too much about it.

Mr. Robert H. Blackall: I should like to ask Mr. Synnestvedt if it is customary in some countries to give a patent on a device, with the proviso that it be manufactured within a certain number of years; and if that has ever been done in the United States.

Mr. Synnestvedt: To answer the last portion of your question first,—that is not the practice in this country. The patentee in this country is privileged to absolutely refuse to make the device during the period the patent covers, and also to absolutely refuse to let anybody else do it on the payment of any royalty he might offer. He is free, under our law, to bury it, if he pleases, for the life of the patent, and the patent will still continue to be valid. Of course there is some equitable loss to the patentee who does that, because if somebody else starts to make it and he brings suit against him, the judges are not disposed to look with very much favor on his suit. It is a saying in the patent law that a "paper" patent is not as good to sue on as one which covers an article of manufacture or of commerce, but I want to say that there is no express basis for that in our law, and many patents have been sustained by the law which have never been manufactured by the patentees.

Now, as to the question as to foreign countries, it is almost universal in foreign countries to require a "working" of the invention, as they call it, within a certain specified time. In Canada they require working of the invention within two years, I think it is, after the granting of the patent. And then there are certain rights of extension that you can get by making an application. In Great Britain they do not require working of the patent, but they require payment of annual taxes, beginning after the fourth year, and every year thereafter. In France, Germany, Belgium, and I guess almost all of the European countries, and a great many of the other countries, including some of the South American countries, the law requires that the patent be worked within a certain limit of time, or the patent becomes forfeited. And in many of those countries there is also a requirement for the payment of annual dues, or for dues to be paid at certain times; and on the failure either to work the patent or to pay the annuities, as they call them, the patent becomes forfeited. Annuities in Russia gradually increase from the first year up until the end of the life of the patent, which is fifteen years, until at the end of it they are exhorbitant. That annuity requirement is not in force in this country, either.

Mr. D. J. Redding: I would like to ask Mr. Synnestvedt if the purchase of a patented article in this country gives the purchaser the right to renew any or all parts of the patented article as they wear out in all cases, or whether the patentee can insist on selling those parts that wear out?

Mr. Synestvedt: There are two points to be considered in answer to that. The first is as to the extent of the repair, and the character of the patented claim. And the next is as to whether any of the parts separately are the subject-matter of individual claims in patents. If you assume that any one of the separate parts that go to make up the combination are patented separately, suppose the patent is on ABC; suppose the only patent that exists is on the patent ABC, under the law you are entitled to repair those parts by the substitution of a new A, of a new B, or of a new C, until the entire combination has worn out, so long as you do not construct an entirely new combination. The substitution in a combination of that kind of so many new parts that it practically makes a new article has been held in some cases to be an infringement of the patent. But as a general rule the courts are disposed to treat a matter of that kind rather liberally, and to take the attitude that the patentee has secured his reward in the royalty, or in the percentage of profit which accrued to him at the time of the original sale or purchase.

I should like to add one more qualification to that, and that is that there is hardly any limit in this country to the conditions that may be attached by the patentee to the license right granted in conjunction with the sale of a patented article. And if the patented article be sold with any condition attached, such as, for example, that the patentee reserves the right to supply renewals, and all that kind of thing, and the license is granted for the use of it and expressly on that condition, then I think that license would be held good. There are sometimes a great variety of conditions of that kind attached. I think the best known instance of that is the case of some of these binding-straps for bales. There was a patent on the fastening of those, and some people got to taking the old ones and using the fastening over again; then the manufacturers sold them with the understanding that that was not to be done, and the right to so limit the use was sustained.

Mr. E. W. Summers: I should like to ask Mr. Synnestvedt another question, with regard to the limitation on royalties: for instance, a patentee charges a certain royalty for the use of a patent, and he finds afterwards that he has not charged enough. Will he have a right to increase the royalty? That is on the line of limitations just spoken of.

Mr. Synnestvedt: Royalty is generally a matter of special contract, a license contract; and I should say that if the patentee sells an article with the right to use, at a certain royalty, without any specification or any statement as to the time during which it might be used, or without any restriction whatever as to the period, that there would not be any chance for him to raise the royalty or to demand any additional compensation, or to interfere with the continued use of that patent to the expiration of the life of the patent. But if the royalty is payable only at stated intervals and covers only a stated time, at the end of the period, unless there is something to prevent it in the contract, the royalty could probably be raised.

The fact that a royalty has once been at a certain figure does not necessarily mean that it has to be held there. It is the privilege of the patentee to cut off the royalty agreement altogether. Of course he has no right to violate a contract; but it is his privilege at any time he chooses, to say, from now henceforth I will not do anything with this; I will put it on a shelf. I will not manufacture or sell, or let anybody else manufacture or sell. I say that is apart from any existing contract. Every sale of a patented article, where there is not special contract attached, carries with it the license right to use that article; and that cannot be revoked afterward.

Mr. D. J. Redding: There is another question that occurs to me, in connection with that. There seems to be a superstition that if a person in the employ of any company takes out a patent of any description that is useful to that company, the company would have the right to use it without paying him any royalty on it. Is there any basis for that belief?

Mr. Synnestvedt: That, also, depends on the conditions of the case. That is a case like some of these others, where it is difficult to lay down a fundamental proposition. But it has been well settled, I think, that an implied license arises to an employer to use an invention made by one of the employees, in the employer's time and at the employer's expense; but that right is not in its nature or shape an exclusive right, or anything more than just a mere simple license. That is the general doctrine. That is pretty well established by Supreme Court decisions.

If the employee has made an invention in his own time, that is, out of hours, and has experimented and perfected that invention also in his own time and at his own expense, then the employer has no right to it at all, outside of some express agreement.

Mr. Willis C. Squire: What interference is there in making an application for a patent that may have been granted by some foreign country? For instance, I believe it is true that if a patent is published in the United States, and the right is granted the patent, that a patent will not be granted by foreign countries afterward on application. Is there any limitation to patents granted in this country because of patents granted on similar lines in other countries?

Mr. Synnestvedt: That same rule holds good; not because the same patent has been issued in a foreign country, not because the invention has been patented abroad; but because a prior publication invalidates the right. I think I can give that in a nutshell here. Here is the Federal Statute on that point: "Any person who has invented or discovered any new and useful art, machine, manufacture, composition of matter, or any useful improvement thereof not known or used by others in this country." "And not patented or described in any printed publication in this or any foreign country." You see the publication of the patent or the description in any printed publication in this or in a foreign country, would be a bar.

Mr. Willis C. Squire: Does that mean patents would have to be taken out simultaneously in all foreign countries, in order to protect yourself against foreign rights?

Mr. Synnestvedt: The practice generally is to file all your foreign cases at the same time. The law is different in different countries; but, as a general rule there is a general principle runs through them all. At the present time the better way is to file them all at the same time.

Mr. Willis C. Squire: In other words, you do not push the claim until after the foreign claim has been filed?

Mr. Synnestvedt: Yes, for in many of the foreign countries the prior grant of the United States patent would invalidate the foreign patent. If you let the United States patent issue before you file your foreign patent, then you are liable to get an invalid foreign patent.

Mr. Willis C. Squire: Then in a foreign country, if an article is patented here and published, it gives the right to a foreigner to use it?

Mr. Synnestvedt: That is the general doctrine. There are limitations to that. There is the International Convention or Agreement. That is, if you file in the countries belonging to that Convention within a certain number of months you may get a valid patent, although the United States patent may have issued.

Mr. Willis C. Squire: That is an international agreement between certain powers?

Mr. Synnestvedt: Yes, sir; and only applies to those who signed that agreement. There are certain of them who do not belong to that. I cannot say off-hand who they are, but nearly all of the important European countries are members of that Convention, and the time of that has been extended recently from seven months to one year.

Mr. Willis C. Squire: Is it not a fact that in the granting of patents at the United States patent office you are really at the mercy of the examiner? Are you not at his mercy unless you have a good lawyer on your side?

Mr. Synnestvedt: Of course I do not want to discourage you from getting good lawyers. (Laughter.) At the same time there is this protection, in that there are several appeals. You are in a measure at the mercy of the examiner, to the extent that if he makes up his mind that he will not give you a patent, whether justly or unjustly, he may put you to the annoyance of an appeal. But you can appeal, if he rejects you from the primary examiner to the Board of Examiners (there are three of them), and if you can get two of them you get a patent. But if two of them go against you and hand down a decision contrary to the grant, then you can take an appeal to the Commissioner. Then if you are not satisfied when the Commissioner refuses, you can take an appeal to the Courts, the Circuit Court of the District of Columbia. And then there is still an opportunity, by filing a bill in equity in some United States Circuit Court. So, you see, you have a great many more appeals and chances on it than in most legal proceedings.

Mr. Willis C. Squire: There is plenty of chance to spend your money on a will o' the wisp?

Mr. Synnestvedt: Some people have carried their patents through the patent offices, and been beaten, and secured their patents in the courts. I should not advise a man to take chances on that, unless the patent is worth considerable money, because it is sure to be a very expensive proceeding.

Mr. Willis C. Squire: You brought up a question in your discussion, interjected in the reading of your paper, relative to the matter of interference. In the case of two men having the same line of thought and making an application for the same thing, with a claim but slightly different: it becomes a case of priority, does it not, and proof of work, similar to a mining claim? The fellow who is on the ground gets it?

Mr. Synnestvedt: Where two applications come into the office with the same claim, the two cases are put into interference, and then you have come into such a contest as you have indicated, to prove priority. And priority of invention alone is not sufficient. There is the question, also, of diligence. The man who was later in making the invention, but was more diligent, may win. The rule fundamentally is that the person who first conceived the invention gets the case, if he has shown that he was reasonably diligent, regardless of what the other man has done; but a great many cases are decided against the man who was first to think of the invention, simply because he neglected to give the public the benefit of it and to do anything with it.

Mr. Robert A. Blackall: I should like to have Mr. Synnestvedt give us a few words on what a caveat consists of.

Mr. Synnestvedt: My opinion is that a caveat is a delusion and a snare. I have been strongly in favor of abolishing the caveat law, and I think that that will be done before long. The caveat law came into existence a long while ago, I think about 1836, and at that time the idea which was involved in that law was to give the man who made the invention an opportunity to develop and perfect it, pending the decision as to his application in the patent office. And there is a certain element of justice and sense in that. But the present practice in relation to applications has become so liberal that there is no longer any use for a caveat; and a man is better protected to file his application at once on an invention, and then to take advantage of the liberality in the patent office in the prosecution of that application, than he is to file a caveat and then afterwards have it perfected into a patent. The caveat never gives a man any protection unless it is turned into a patent later on. And another thing about it is that while it is put into the office with the express idea that the patent examiner is to notify the filer of it in the case of any interfering rights, in many instances they are simply stuck into a pigeon-hole and forgotten, and the applicant fails to get notice in a great many cases. You very seldom fail to get notice if you have an application. The present law allows one year's time to file an amendment after the first action, and upon every new ground of rejection which is advanced by the patent office, there is another year which may be availed of to prosecute the case. So, by carefully framing amendments, and keeping the case in the office pending the practical development in the improvement, a very strong patent can often be secured, and advantages obtained, which could not be obtained under the old practice with a caveat.

I am very much opposed to being in a rush with the issuing of a patent in most cases, because it is my experience that in nine cases out of every ten, at least, if not more than that, the patent improves with age. It is like whisky, becomes better the older it gets. If you can keep it in the patent office during the preliminary stages of the development, when the patent finally issues you will have a much better patent. The development of the improvement nearly always brings out more clearly the substance of the invention, and it is really seldom that it is possible, in the first filing of the papers, to make a clear-cut distinction or description as to what really constitutes the important feature of the invention. And that is the secret of a good patent, to define the very essence of the thing, and to leave everything else out; and that can best be done by a process of gradual elimination and exclusion, after you get the case on file. A patent that has been pending in the patent office for two or three years is almost invariably a better patent than one which has only been in three months. Besides that, if the invention is an important one, that adds that much more to the life of the patent, because the term runs from the date the patent is issued, and not from the date you file.

Mr. A. Stucki: May I ask what are the terms and conditions under which a patent can be renewed, after it has run a full term.

Mr. Synnestvedt: Only by a special act of Congress, and there has not been any patent renewed since the present statute went into force, and that is many years ago. It cannot be done unless Congress wants to pass a special act; or they could possibly pass a general act and reinstate the old law, where we had a fourteen year term, with the right of renewal for another fourteen years. But when they changed the term, and made it seventeen years instead of fourteen, they cut out that renewal provision altogether. That is a very different thing from what we call a re-issue, when there has been some defect in the patent, and we get it re-issued to cure the defect. That generally has to be done within two years of the issuance of the patent, but does not extend the life of the patent.

Mr. Willis C. Squire: Mr. Synnestvedt's answer to that is like a polite phrase. The man works it so "you have another guess coming."

Mr. E. W. Summers: I want to ask Mr. Synnestvedt if the improvement of the patent by working it up a long time does not depend on the specifications started out with? If he should think of some improvement later on that is not shown in the application, he has, as I understand it, no recourse but in the filing of another application.

Mr. Synnestvedt: That is undoubtedly true. The case must always be restricted to what they call the original disclosure,—what you put in in the first instance. You cannot add new matter to any case which is on file, but you can enlarge or cut down or alter the claim almost without limit; and you can strike out a clause and put in a new clause several times, if occasion requires. You can put in new specifications to accord with the drawing, or you can put in new drawings to ac cord with the specifications. You can do all sorts of things after it is in there. But you cannot put any new matter into the case; you cannot put in a new patent.

Mr. D. J Redding: If you have been using an article which has never been patented, right along for years, and some other fellow comes along and patents it, could he prevent you from using that any further except on the payment of royalty?

Mr. Synnestvedt: No, he cannot. He might sue you under the patent, but you can set up in defense prior knowledge of the invention, or prior use, and if he cannot show that he invented it before you began to use it, or before you had knowledge of it, it invalidates his patent. There is another provision in the law, which is distinct, entirely, from that, and that is that where an inventor has had the thing in public use for two years before application, then he cannot hold a valid patent.

Supposing that a man designs some improvement and puts it into public use where everybody can see it, even if he has but one of them in public use and it is not mere experimental use, and he keeps it running for a period of two years,—then he forfeits his right to the patent if he has not filed his application within that time. But two years is not required where the use is by somebody else. Two days will suffice, if you can clearly show that you had it two days before he had it. Or if he cannot show, when it comes to proof in Court, that he had it before you had it, it would invalidate his patent.

There being no further questions nor remarks upon this subject, the discussion was declared to be closed.

Mr. J. D. Milligan: I move, Mr. President, that a vote of thanks be tendered to Mr. Synnestvedt for his valuable paper; and not only for the paper, but as well for the discussion of the subject afterward, which has afforded us a great deal of pleasure.

The motion was duly seconded, and on vote of the Club was concurred in. And the thanks of the Club were tendered by the President.

President: I wish to announce that at the next regular meeting will be held the annual election of officers, and also the annual smoker. We hope that every member who can be present, will be here. We hope to have a pleasant time.

On motion, the meeting adjourned.

NOTICE.

Bound copies, Volume No. 1 of our Club Proceedings for the year 1901–1902 are now ready for distribution. They will be mailed to those desiring them upon receipt of fifty cents. The supply is limited.

J. D. Conway,
Secretary.

MINUTES OF THE RAILWAY CLUB SECRETARIES MEETING, JUNE, 1903.

Saratoga, June 26, 1903.

The Society of Railway Club Secretaries met in annual session at the United States Hotel and was called to order by Vice Chairman Joseph W. Taylor, of the Western Railway Club. Roll call showed the following representation:

New York Railroad Club—D. M. Brady.

Western Railway Club—Joseph W. Taylor.

Central Railway Club—Harry D. Vought.

Southern and Southwestern Railway Club—A. J. Merrill and W. L. Tracy.

Railway Club of Pittsburg—John D. Conway.

In the absence of some of the members it was agreed to defer the transaction of regular business until June 27, at 11 A. M.

A. J. MERRILL, Secretary.

Saratoga, June 27, 1903.

The Society met pursuant to adjournment and was called to order by Chairman E. L. Janes, of the New England Club.

Present—Messrs. Taylor, Brady, Conway, Vought and Tracy: Mr. Brady stating that he was acting as proxy for Mr. F. M. Whyte, of the New York Club.

On motion of Mr. Taylor, the duties of secretary pro tem were assigned to Mr. Vought, owing to Secretary Merrill having been obliged to return home. The minutes of the meetings of 1902 were approved.

On motion of Mr. Taylor, the Iowa Club was admitted to membership, subject to the payment of the customary fee of $5.00.

Under the motion of Mr. Tracy, the Richmond, Va., Club was admitted on the same condition.

Mr. Taylor moved to amend the rules of order so as to provide that the date and time of future meetings shall be held subject to the call of the Chair; that the election of officers shall be the last order of regular business at the annual meetings of the Society, and that presidents and first vice presidents of clubs that are members of the Society shall, during their respective terms of office, be enrolled as associate members of the organization, with all the privileges of active members except voting at the election of officers. These were agreed to and ordered submitted to letter ballot for ratification and adoption.

The report of the Secretary-Treasurer showed total receipts of $82.46 and disbursements aggregating $8.50, leaving a balance on hand of $73.96.

Mr. Conway moved that the Chairman be a committee of one to provide a gold membership badge of appropriate design, such badges to remain the property of the members after their retirement from active membership. Carried.

Mr. Vought moved that Mr. Brady be elected an honorary member of the Society and presented with membership badge in recognition of the fact that he was the first man to be elected Secretary of a railroad organization, and that he is the founder of the Society. Carried.

Mr. Brady tersely expressed his appreciation of the honor conferred upon him and at the same time availed himself of the opportunity to invite the Secretaries to be the guests of the Executive Committee of the New York Club at the luncheon served in connection with their meetings.

The per capita assessment upon the various clubs for the expenses of the Society was fixed at $10 for the ensuing year.

The acknowledgements of the Society were voted to the Supply Men's Association for extending to its members the courtesies of the annual conventions, and to Mr. A. M. Waitt, ex-President, and Mr. George W. West, President of the American Railway Master Mechanics' Association, for their kindly and thoughtful interests in prompting this recognition of the Society.

Mr. Taylor, in behalf of the Executive Committees of the Master Car Builders' and Master Mechanics' Association, asked that the subjects scheduled for the next annual convention be made, as far as practicable, a matter of committee reports and discussion by the various clubs during the ensuing year.

On motion of Mr. Brady, it was ordered that this recommendation be made as suggested.

The New England Club recommended that the secretaries append to printed proceedings a schedule showing subjects discussed by sister clubs at their last preceding meetings. It was agreed that notification cards of meetings be exchanged by members in order to facilitate the carrying out of this proposition.

Representatives of clubs that had adopted the rule of charging members for reports of sister clubs reported that it operated to the satisfaction of their respective organizations.

There being no further business, it was agreed to defer the election of officers until Monday, June 29, at 4 P. M., to which time adjournment was taken.

HARRY D. VOUGHT,
Secretary Pro Tem.

Saratoga, June 29, 1903.

The Society met pursuant to adjournment at the United States Hotel, and was called to order by Chairman E. L. Janes, the members responding at roll call being as follows:

New York Railroad Club—D. M. Brady.

Central Railway Club—Harry D. Vought.

Western Railway Club—Joseph W. Taylor.

New England Railroad Club—E. L. Janes.

Northwest Railroad Club—D. Van Alstyne, President.

Southwestern & S. W. Railway Club—W. L. Tracy, ex-President.

Railway Club of Pittsburg—J. D. Conway.

Canadian Railway Club—W. H. Rosevear, Jr.

St. Louis Railway Club—E. S. Marshall, Executive Committee.

Richmond, Va., Railway Club—J. F. Walsh, President.

At the suggestion of Mr. Van Alstyne, and on motion of Mr. Conway, it was resolved to publish an index of subjects discussed by the various clubs since June, 1902, a sufficient number of copies to be furnished to each club in time for distribution to its members in advance of the September meetings.

It was further agreed that after the changes in the rules of the Society had been submitted to letter ballot, a revised edition of the Society's prospectus should be issued and distributed.

There being no further routine business before the Society, the election of officers followed, with the following result, and a vote of thanks to the retiring officers, the meeting adjourned subject to the call of the Chair.

Chairman, Joseph W. Taylor,
Vice Chairman, J. D. Conway,
Secretary and Treasurer, Harry D. Vought.

HARRY D. VOUGHT,
Secretary-Treasurer.

EDWARD KERR, President. W. R. BROWN, Supt. G. W. GOSSER, Sec'y and Treas.

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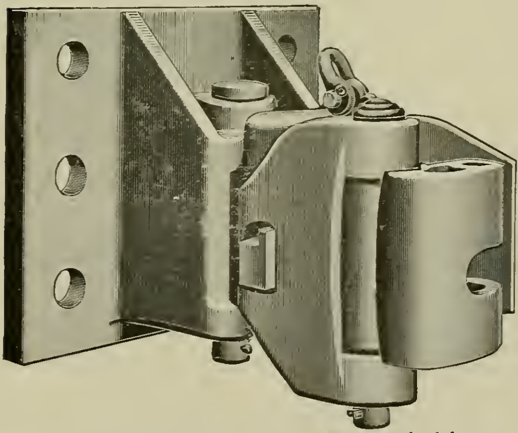

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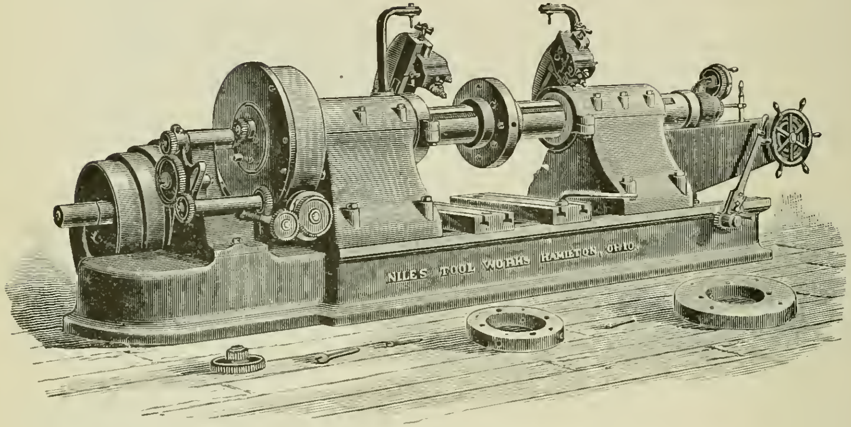
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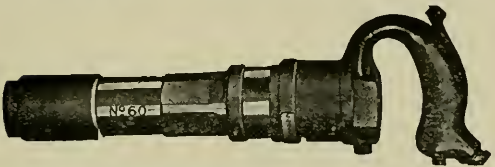

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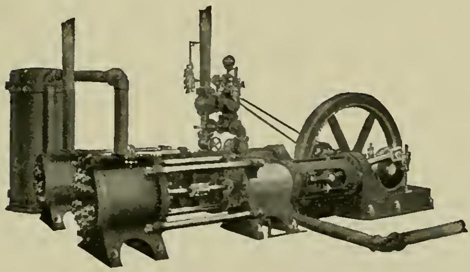

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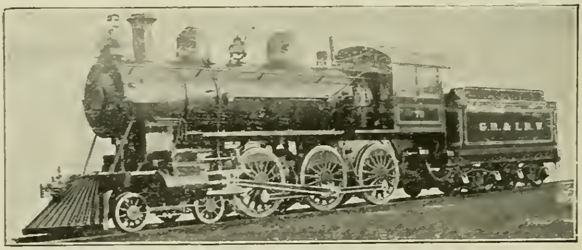

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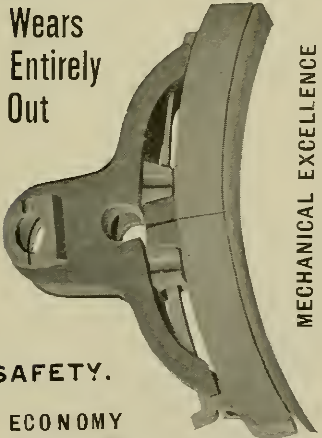

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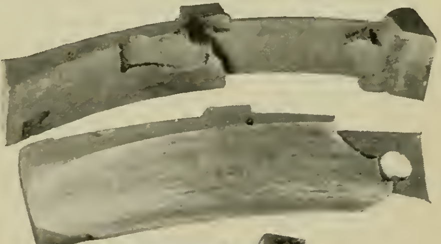

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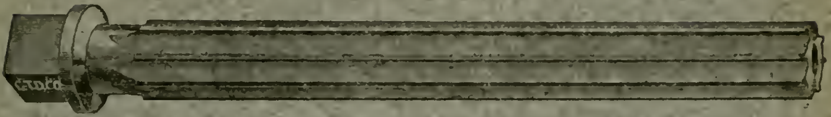

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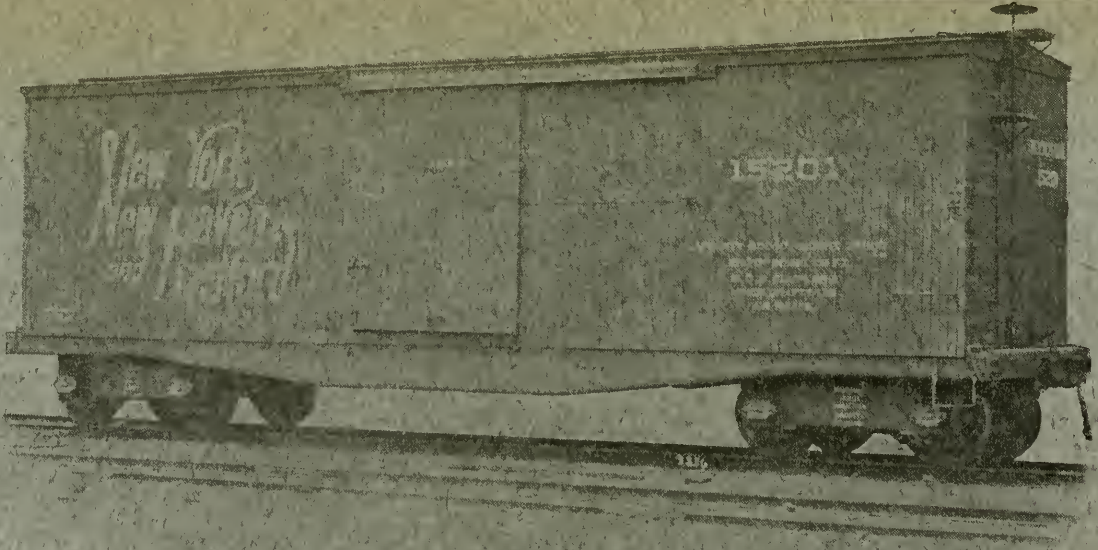

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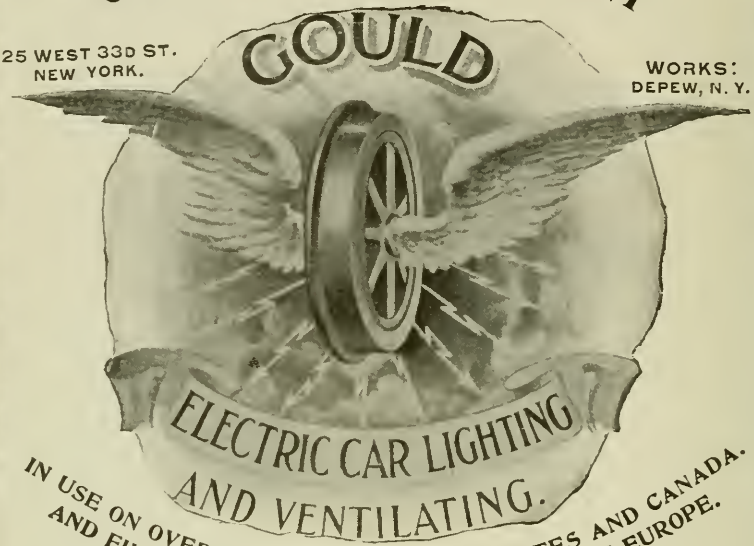

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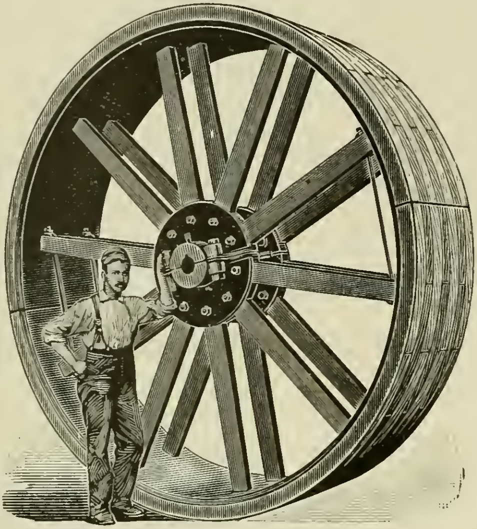

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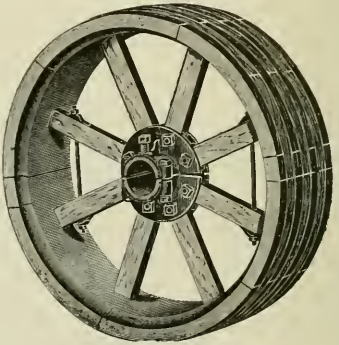

OFFICIAL PROCEEDINGS
of the
Railway Club *of* Pittsburgh.
ORGANIZED OCTOBER 18, 1901.

OFFICERS, 1902 - 1903.

President,
J. H. McCONNELL,
Manager American Locomotive Co., Pittsburgh, Pa.

Vice-President,
L. H. TURNER,
Supt. Motive Power, P. & L. E. R. R.
Pittsburgh, Pa.

Treasurer,
J. D. McILWAIN,
Sales Agent, J. D. McIlwain & Co.,
Pittsburgh, Pa.

Secretary,
J. D. Conway,
Chief Clerk, Supt. M. P., General Offices P. & L. E. R. R , Pittsburgh, Pa.

Executive Committee,

D. F. CRAWFORD,
Gen'l Supt. M. P. Penna. Lines West of Pgh.
Pittsburgh, Pa.

J. E. SIMONS,
General Manager, O. M. Edwards Company,
Syracuse, N. Y.

F. T. HYNDMAN,
M. M., Bflo., Roch. & Pgh R. R. Co.,
Du Bois, Pa.

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Pittsburgh, Pa., October 23, 1903.

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J. D. Conway, Secretary, General Offices P. & L. E. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF ANNUAL MEETING,
OCTOBER 23, 1903,

The meeting was called to order at 8 o'clock, p. m., at the Hotel Henry, by President J. H. McConnell.

The following gentlemen registered :

MEMBERS.

Allen, Jas. P.
Anderson, H. T.
Ayers, H. B.
Bell, W. K.
Berkebile, R. L.
Blackall, R. H.
Blest, M. C.
Bole, Robt. A.
Bowery, Frederick
Brittain, J. B.
Brown, E. W.
Buchanan, W. J.
Campbell, G. M.
Carpenter, Frank
Carson, G. E.
Clancy, J. R.
Clarke, H. P.
Conway, J. D.
Darby, H. F., Jr.
Davis, Tom R.
Diamond, P. R.
Dow, G. N.
Dreyfus, T. F.
Fitzgerald, O.
Flinn, C.
Frost, Harry W.
Gibb, J. B.
Gies, Geo. E.
Gillen, Jno.
Grove, E. M.
Hall, W. G.
Hallett, R. C.
Harris, J. D.
Hastings, C. L.
Hood, Chas.
Hoffman, N. K.
Howe, D. M.
Lobez, Pierre, L.
Macoubray, R. J.
Malloy, M. A.
Mason, Stephen C.
Mechling, J. E.
Miller, Chas. R., Jr.
Miller, Geo. W.
McCaslin, A. W.
McConnell, J. H.
McFeatters, F. R.
McIlwain, J. D.
McNulty, F. M.
Oates, Geo. M.
Obey, G. B.
Palmer, Chas. A.
Partington, Jas.
Porter, Chas.
Porter, Hon. H. K.
Porter, H. V.
Postlethwaite, C. E.
Quest, W. O.
Redding, D. J.
Reilly, E. S.
Richardson, W. P.
Robinson, F. M.
Safford, J. B.
Scheck, H. G.
Schoeneman, C. J.
Schuchman, F.
Shaler, Fred J.
Shannon, Chas.
Simons, J. E.
Simmons, W. M.
Slocum, A. W.
Smith, D. W.
Smith, Ross W.
Stark, B. F.

Howgate, Jas. R.
Hukill, J. L.
Hunter, H. S.
Hurley, J. L.
Hyndman, F. T.
Jefferson, E. Z.
Jenny, Jacob
Kelly, Moore
Keppel, A. M., Jr.
Kerr, Geo. M.
Kerr, Edward
Kessler, D. D.
Klee, W. B.
Lafferty, H. C.
Lee, Louis A.
Lindstrom, Chas.
Lininger, W.
Lininger, E. W.
Stark, F. H.
Stovel, R. W.
Strattan, G. W.
Stucki, A.
Sweeley, G. P.
Tesseyman, J. E.
Thomas, E. C.
Tucker, John L.
Turner, L. H.
Van Tine, H. C.
Ward, Jno.
Watrous, E. P.
Weisbrod, J. F.
Wendt, Edwin F.
Whinery, S. B.
Winterhalter, W. C.
Wright, R. V.
Wright, Wm.

VISITORS.

Blaney, H. F.
Burry, Vincent
Dunlevy, Jas. P.
Glasser, Chas. H.
Hamnett, Jas. H.
Hayward, Henry S.
Herrmann, J. C.
Huyett, E. G.
Johnson, Jno. F.
Lloyd, Wm.
Lane, A. A.
Leibert, John
Lucas, G. C.
Macfarlane, W. E.
Mackenzie, P. E.
Melson, W. C.
Mendenhall, C. M.
Nicholas, H. N.
Paisley, J. A.
Pruden, H. B.
Quest, F. E.
Russell, N. S.
Scovell, W. N.
Statler, L. D.
Steinbrenner, G. A.
Stinson, C. P.
Swearer, Howard R.
Waefelaer, Louis,
Wilkinson, Jas. A.
Winsch, Hans

The minutes of the last meeting having been printed the reading of them was dispensed with.

President McConnell: Gentlemen—The business part of this meeting will occupy but a few minutes. It might be well, however, in starting out, to say that this Club was organized two years ago this month. At the preliminary meeting 49 members were present, and it was understood that the first regular meeting of the Club should be held in November and that all who desired to join before that time should be considered charter members. At the November meeting we had about 200 members. Since that time the Club has grown considerably, and at the present time we have 412 members.

We have had during that time fifteen subjects presented, which have been discussed in a very entertaining and interesting manner. The Secretary advises that the printed proceedings of the Club have been sent to Europe, to Canada, to South America and to Mexico.

The By-laws provide that every member of the Club shall have the right and opportunity to vote for officers, whether he is present at the meeting or not. Accordingly printed ballots were sent to each member of the Club. The votes have come in and the returns have been canvassed and Mr. L. H. Turner has been elected president. (Great applause.) Mr. F. T. Hyndman has been elected vice president; Mr. J. D. McIlwain re-elected treasurer, and our efficient secretary has been re elected; and an executive committee consisting of Mr. E. M. Herr, Mr. F. H. Stark and Mr. C. L. Gist, have been elected. (Applause.)

The secretary and treasurers report will not be read this evening, but they will be published in the journal. The treasurer, however. reports that he has about $969 on hand. Let us hope that is true. (Great laughter and applause.)

Mr. Turner, permit me to congratulate you on being elected president of this Club and to commend the Club for its choice. Gentlemen, permit me to present to you your new president, Mr. L. H. Turner. (Great applause.)

Mr. Turner: Gentlemen—I want to express my thanks for the honor you have conferred upon me. And I ask you to give me the same hearty support that you have given our retiring president, Mr. McConnell, who has added so much in placing our Club on the solid basis on which it stands to day.

Mr. F. H. Stark: It gives me great pleasure to bring before the Club at this time a matter that is of interest to each one of us. We appreciate that Mr. McConnell is the first president of this Club, and he was largely instrumental in bringing about the results. It was of advantage to us to have so able a representative, both as a mechanical man and as a presiding officer. We appreciate the manner in which he has governed this body, and I feel that as a matter of appreciation it would be well for us to express our gratification and appreciation of his able services. Therefore, if it is in order at this time, I offer a motion that it is the sense of this body that we extend to Mr. McConnell our thanks by a rising vote.

The motion, being duly seconded, was put to rising vote and carried unanimously.

President Turner: Mr. McConnell, it gives me great pleasure to extend to you the thanks of this Club for your efforts in guiding our footsteps.

Mr. McConnell: Gentlemen—I wish to thank you for the courtesy and consideration with which you have always treated me. It has been a pleasure to be a member of the Pittsburgh Club and it also has been a pleasure to preside over this body. I am satisfied that in the election of the new president we have entered on another year of renewed prosperity, and I think that the next year will show that the Club will increase under his management more than it has done in the last two years. I thank you.

Secretary Conway read the list of applicants for membership as follows:

Ayers, H. B., Gen'l Supt. American Locomotive Company, Pittsburgh Works, Allegheny, Pa.

Brittain, J. B., Asst. to Comp., Penna. Lines, Union Station, Pittsburgh, Pa.

Caton, E. L., Dept. Manager, U. S. Metal & Manufacturing Company, 1509 Arrott Building, Pittsburgh, Pa.

Dyer, J., Chief Joint Inspector, P. & L. E. and Erie R. R. Co's, Youngstown, Ohio.

Hyde, J. C., Supt. B. R. & P. Ry., Butler, Pa.

Osborne, H. C., Supt. Masonry and Water Supply, P. & L. E. R. R. Co., P. & L. E. General Offices, Pittsburgh, Pa.

Robinson, Frederick M., Pressed Steel Car Company, Farmers Bank Building, Pittsburg, Pa.

Schauer, A. J., Asst. Train Master, P. R. R. Co., Monongahela City, Pa.

Spencer, Robert, Rep. Shelby Steel Tube Company, Havemeyer Building, New York City.

Thomas, Chas., General Yard Master, P. & L. E. R. R. Co. McKees Rocks, Pa.

VanTine, Harry C., Pressed Steel Car Co., 100 E. North Ave., Allegheny, Pa.

Ward, John, Blacksmith Foreman, Monongahela Connecting Railroad Co., Pittsburgh, Pa.

Wilkinson, Jas. A., Pur. Agent, McClintic-Marshall Construction Co., 224 Elm St , Edgewood Park, Pa.

President Turner: Gentlemen—After these names have been favorably passed upon by the Executive Committee they will become members of the Club.

I have to announce the death of one of our members, Mr. Thomas Anderson, General Manager of the Youngstown Car Works. And if there are no objections the Chair will appoint as a committee to draft proper resolutions Mr. G. P. Sweely, F. H. Stark and I. N. Kalbaugh.

Inasmuch as the result of the vote for officers has been announced to you and the official vote will be printed in the next proceedings, we will omit the reading of that report to-night.

The vote for the various officers to serve for the year 1903-1904 is as follows, the highest vote for each office only being shown:

For President, L. H. Turner, received 71 votes.

For Vice President, F. T. Hyndman, received 53 votes.

For Secretary, J. D. Conway, received 84 votes.

For Treasurer, J. D. McIlwain, received 69 votes.

For Executive Committee, E. M. Herr, received 49 votes; C. L. Gist, received 47 votes, F. H. Stark, received 45 votes.

REPORT OF THE SECRETARY.

This meeting closes the second year's existence of this Club, and it would seem proper that your Secretary give a brief summary of events during the year just closed.

The last annual report showed a membership of 312, and we now have a membership of 412, showing a gain of 100 members. This shows that the interest of the Club is not decreasing.

The papers read and discussed during the year have been of that high order only obtained by a thorough knowledge of the subject by the author. One thing particularly noticeable is the fact that these papers were void of similarity, thus presenting a wide range of thought which appeals to all classes of interest. The mutual good, resultant from Railway Clubs in this country has come to the attention of our English cousins across the water. Within the last two months we received a letter from one of the most prominent technical journals in England, asking for particulars as to the character and formation of our Clubs.

We have added a new feature to our meetings, by having luncheon served after adjournment, which has added very materially to the benefit of the Club socially. Our attendance at the meetings has increased 35 per cent. over the previous year.

The financial condition of the Club is healthy ; while we do not show a large surplus on hand, there is no reason for complaint, and it is not at all likely that we will go into the hands of a receiver, at least, not so long as our patron friends, the advertisers, throw out the life line.

Within the year we have lost by death the following members : Col. David P. Jones, E. S. Mason, Thos. Lindsay, Wm. H. Bown and Thos. Anderson.

The following is a summary of the financial condition, etc., of the Club up to and including this meeting :

MEMBESHIP.

Reported last year	312	
Received into membership	121	433
Suspended, non-payment of dues	3	
Resigned	13	
Removed by death	5	21
Present membership		412

FINANCIAL.

RECEIPTS.

In hands of Treasurer last year........	$ 548.15	
From advertisements......................	1,480.57	
From dues....................................	1,267.00	
From sale of Proceedings................	3.00	$ 3,298.72

DISBURSEMENTS:

Printing Proceedings, Advance Sheets and Notices..................	$1,146.77	
Postage..................	51.31	
Reporting Proceedings..................	135.00	
Secretary's Salary, 1901-1902..........	500.00	
Secretary's Trip to Saratoga...........	50.00	
Stationery and incidental supplies....	14.75	
Hotel Henry, for luncheons served...	348 00	
Entertainment........	38.00	
Binding Proceedings, year 1901-1902,	45.47	$ 2,329.30
Balance in hands of Treasurer...		$ 969.42

J. D. CONWAY,
Secretary.

Approved:

D. F. CRAWFORD }
F. T. HYNDMAN } Executive Committee.

TREASURER'S REPORT

FOR THE YEAR ENDING OCTOBER 1903.

Your Treasurer begs leave to present his annual report for the year ending October, 1903.

Balance on hand, last report...............	$ 548.15	
Received from Secretary.....................	2,750.57	$ 3,298.72
Paid out on Secretary's Checks...........	$2,329.30	
Balance on hand, October, 1903...........	969.42	$ 3,298.72

J. D. MCILWAIN,
Treasurer.

Approved:

D. F. CRAWFORD }
F. T. HYNDMAN } Executive Committee.

President: We will now have the pleasure of listening to an address by a gentleman whose name is familiar to you all, not only as a representative citizen of our city but as our representative at Washington, the Hon. H. K. Porter.

Hon. H. K. Porter: Mr. President and gentlemen of the Railway Club of Pittsburgh—Brother Members—for I have the pleasure of being a member of this Club, even if I have never put in a personal appearance before. I am sorry that our friend and our president has introduced me as being prepared now to make an address to you, because I have really not come in any such formal way or with any thought of such formality in my mind. I received a very pleasant invitation a week ago, on my arrival home from a trip abroad, from my friend Mr. McConnell asking me to be here with you this evening and to say a few words on any subject that might come into my mind. And inasmuch, especially, as once before I received a particular invitation to come here and it was announced that I would be present—though that was not in accordance with my wish and really against my protest—and I was prevented from keeping the engagement. I immediately accepted, and accepted with great pleasure, the invitation to be here tonight. But it was without the slightest thought of coming to make a formal address. And at any rate I have the idea that this is a smoker, and that a smoker is not the place for a set address.

I came in but a moment ago and I am not quite sure but I think this has been your annual election, and your Club has passed through the second year of its existence and entered upon its third. I am extremely gratified to see such a gathering as this. It is extremely interesting to meet men who are connected with the railway interests of this great country. and those railway interests are very broad. I presume that there are a great many here who are not identified with any particular railroad; yet here are these great interests, and the trades and occupations and professions that are naturally connected with them, whose representatives meet for social intercourse, for the cultivation of present friendships and for the discussion of subjects pertaining to the improvement and advancement of this part of our great commercial life, and social life and national life, and international life—for this whole system of work has been a growth.

A few years ago some friends of mine celebrated their golden wedding. It was the fiftieth anniversary of their marriage. Fifty years of the development of railroads; from the start up to that stage of progress, and in the twenty years that have elapsed since that time, what an immense advance upon anything that we had known before! Here to night you may have seen in the papers the announcement of another test on the Marienfelde-Zossen road in Germany where an electric car was whirled at the speed of over 130 miles an hour!

Who of us can comprehend what the development is to be? Who of us who sees the system of street railways becoming in a comparatively few years almost as extensive a system as the general railroad system here in the United States. Who of us can fully comprehend it? I remember stopping in Richmond, Va., to see the first trial of an electric road which seemed to be a success. I remember riding in 1872 upon the cable roads in San Francisco, which were repeated here and, as some of you will remember, were a great success for a time. But in seven years from the time that the Oakland road was opened it was displaced by electricity. And all these miracles are within our remembrance. They are a matter of every day talk.

In this, what was the secret of improvement, what was the secret of the success and the greater advantage to the world at large? For every one of these has ameliorated all the conditions of life, every one of them is helpful and conducive to the greater advantages of the people at large. What is the real secret of it all? Who of us is there that does not know and does not realize that it is "the man behind the gun"? Who does not know that the elements of manhood come in here, that for the handling of every such great trust—for this a trust, a trust where the people are investing their means, combining their resources, trusting their lives and their properties and the conduct of those large businesses to those who conduct these enterprises—there must be individual men? There has been a little feeling in the last ten or fifteen years in the great development of business, in the awful whirl there has been in our business lives that the individual is to be put out of sight, that he is to be ground down so there will be but a few who by any possibility can rise. I believe that thought is all wrong. I believe that today, as centuries ago, and so long as the world shall last, it is after all the man, and that upon him, his standing, his character, his fidelity in the execution of all his trusts, in the doing of all his work and in every relationship in his life, that it is **the man** that is making for the good of humanity in the success of every one of these enterprises.

And therefore it seems to me that every such institution as this, that has worthy aims, that has noble ambitions, that has a desire for true improvement, that comes making known unto others those things which have been a success in any one department of commercial life and of the railway life in particular, every one is telling for the good of humanity. It seems to me that the general conditions of the world are showing this. I think that nations are drawing closer together. I think that the influence of good men in that direction is bringing nations to see eye to eye more than ever before. During this summer I have been very much interested in the visit of President Loubet to London. Received in the heartiest manner, by all the officials of the kingdom, by the people in the most cordial manner and with the most outspoken welcome. It sent an electric thrill throughout France. They are proud and rejoiced at the honor shown their President, the head of a Republic by that monarchial government. And following that some two or three weeks later came the visit of something like a hundred of the Deputies of France on the invitation of the very prominent members of Parliament in England, receiving an equally cordial welcome from this parliamentary body in an almost official manner, and from the whole people of England. And now, continuing the compliment, the King of Italy comes to the Republic of France, and as I was leaving Paris three weeks ago every preparation was making for his most enthusiastic welcome. Who of us can be anything but rejoiced at such signs of international friendliness?

It is a more painful view of the same subject to look further to the East and to see the sufferings and afflictions of Bulgaria and Macedonia. But even here the fact that Austria and Russia are now uniting to try to assist Macedonia is hopeful. And of course in the still farther East the complication is great and the moment is critical. May we not hope that one of these days that seed which was planted by the Emperor of Russia in the Hague Tribunal will bear fruit and will do away very largely with this whole matter of war between nations? And there is no chord more likely to bind the nations together and to be helpful in this respect than these very interests with which you are connected, these bands of steel and these cords of wire that are making the thought of the whole world one. Tonight we think of these things. Tomorrow we shall read in our newspapers of the incidents that are going on in all the earth, and they are of common interest to us. What is to be the true interest of the world at large is what the individual men are who are conducting these affairs. And this conduct is not simply in some one man at the head of a great enterprise, for he is helpless and it is hopeless to expect anything from him unless associated with him are men who will be useful and efficient and effective in all their work. Isn't this the hope of the Republic, isn't this the hope of the world at large.

I congratulate you on your success of the past years. I wish for you continued and increasing success, and in every way an outgrowth that shall be of the greatest permanent value to yourselves as individuals to this country, and so to the world at large. (Applause)

President: Mr. H. P. Clarke, Superintendent of the Mechanical Department of the Pittsburgh Railways Company, has consented to say a few words to us.

Mr. H. P. Clarke: Gentlemen of the membership of this Club: Our president here has spoken truthfully when he said a "few words" because I will confine myself to a very few words.

I feel doubly honored tonight, first because through the good offices of our former president, Mr. McConnell, I have been introduced to you, and second because I have been permitted to become a member of this organization. I feel, however, that I am something of a back slider in railroad circles, because for a number of years I have devoted my entire time and energy to traction work. And Mr. Porter's remarks came pretty near where I live. Last year I attended a street railway convention at Detroit, and while there I was reminded of some of my struggles a good many years ago in the northwest, and I am going to tell you a little joke that occurred on one of the Michigan railroads that is not manufactured for this occasion but is a fact.

I connected myself with the Detroit, Lansing and Lake Michigan Railroad and was located at Iona, above Lansing some little distance, and eventually, (if you will permit me to say so with all modesty,) I became the boss. Some little time after I was there a young man of perhaps twenty-five years of age, and rather flashily dressed, passed down through the shop arm in arm with Col. Roberts, the master mechanic, and he caught my eye at once. I asked some one who he might be. Says he "Don't you know who that is?) I said No, that I had not been there long enough to know everybody. He said "That is H. H. Smith, Jr.," H. H. Smith was a fine old gentlemen of New England of the old school who was president of the road and this H. H. Smith, Jr., was his son, and he was acting as assistant-superintendent. One day a circus came to Lansing. The family lived at Lansing, and H. H. Jr. struck out at once for the box office for some complimentary tickets. But they told him no, they could not give him any tickets. If they gave every one tickets they might as well go out of business at once. "But," says he, "may be you don't know who I am. I am H. H. Smith, Jr. My father is president of the Detroit, Lansing & Lake Michigan Railroad and we have got a new house in Lansing that cost $40,000 and the brustles on our carpets are so long." (Illustrating about one inch.) "Oh, all right, we will give you some tickets," and they gave him three. That night Smith was at the circus with two young ladies and they occupied a front seat.

When everything was in full blast the clown and the ring-master got into a wrangle in the saw dust, and pretty soon the clown sung out to the ring master in the saw dust: "Hold on, may be you don't know who I am." Says he, "I dont." Says the clown, "I am H. H. Smith, Jr. My father it president of the Detroit, Lansing & Lake Michigan Railroad. We have got a new house in Lansing that cost $40,000 and the brustles on our carpet are so long." (Illustrating about two feet.) Laughter and applause.)

Following the speaking a fine musical program was presented, and the members did justice to an elegant spread.

William H. Bown.

Our Almighty Father, in His infinite wisdom, has removed from among us our fellow member of the Railway Club of Pittsburgh, Mr. William H. Bown, who died suddenly at his home, Pittsburgh, Pa., July 25th, 1903. Therefore, be it,

RESOLVED: That in his death, not only the Railway Club of Pittsburgh, but this community, has sustained a great loss. He early in life became identified with the business interests of this city, being first associated with his father in the firm of James Bown & Son, Gun Dealers, on Wood Street, and for the past fifteen years, General Manager and Treasurer of the Granite Railway Signal Company. Mr. Bown was a character most admired by those who knew him best, endowed with sterling integrity and progressive business principles, and an earnest and unpretentious Christian ; a true friend of all needing sympathy or assistance.

RESOLVED: That we extend to his sorrowing family our sincere and heartfelt sympathy in this, the greatest of all affliction, and be it further,

RESOLVED: That these resolutions be spread on the minutes of this Club and a copy of same presented to the family.

ROBERT A. BOLE,
JOHN T. BROWN,
DAVID O. HOLBROOK.
} Committee.

RAILWAY CLUB OF PITTSBURGH.

CONSTITUTION.

ARTICLE I.

The name of this organization shall be "The Railway Club of Pittsburgh."

ARTICLE II.

OBJECTS.

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III.

MEMBERSHIP.

Section 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

Sec. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV.

OFFICERS.

The officers of this Club shall consist of a President, Vice-President Secretary, Treasurer, and three elective Executive members who shall serve a term of one year from the date of their election, unless a vacancy occurs, in which case a successor shall be elected to fill the unexpired term.

ARTICLE V.

DUTIES OF OFFICERS.

Section 1. The President will preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer ; also serve as a member of the Executive Committee.

Sec. 2. The Vice President, in the absence of the President, will perform all the duties of that officer, also serve as a member of the Executive Committee.

Sec. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

Sec. 4. The Treasurer shall receipt for all moneys received from the Secretary and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by cheque signed by the Secretary and Treasurer.

Sec. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

Article VI.

ELECTION OF OFFICERS.

Section 1. The officers shall be elected at the regular annual meeting as follows : except as otherwise provided for.

Sec. 2. Written forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the three elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

Sec. 3. The three elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

Sec. 4. The President will announce the result of the ballot and declare the election.

Sec. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot.

ARTICLE VII.

AMENDMENTS.

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

BY-LAWS.

ARTICLE I.

MEETINGS.

Section 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Friday of each month, except June, July and August, at 8:00 o'clock P. M.

Sec. 2. The annual meeting shall be held on the fourth Friday of October each year.

Sec. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

ARTICLE II.

QUORUM.

At any regular or special meeting nine members shall constitute a quorum.

ARTICLE III.

DUES.

Section 1. The dues of members shall be $2.00 per annum, $1.00 of same to apply to subscription for Club Journal, payable in advance, on or before the fourth Friday of September each year.

Sec. 2. Each member will be assessed $1.00 extra annually to provide light refreshments for each meeting.

Sec. 3. At the annual meeting members whose dues are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

Sec. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

ARTICLE IV.

ORDER OF BUISINESS.

1—Roll call.
2- Reading of the minutes.
3—Announcements of new members.
4—Reports of Committees.
5—Communications, notices, etc.
6—Unfinished business.
7—New business.
8—Recess.
9—Discussion of subjects presented at previous meeting.
10—Appointments of committees.
11—Election of officers.
12—Announcements.
13—Financial reports or statements.
14—Adjournment.

ARTICLE V.

SUBJECTS—PUBLICATIONS.

Section 1. The Executive Committee will provide the papers or matter for discussion at each regular meeting.

Sec. 2. The proceedings or such portion as the Executive Committee may approve shall be published (standard sixe, 6x9 inches), and mailed to the members of the club or other similar clubs with which exchange is made.

ARTICLE VI.

The stenographic report of the meetings will be confined to resolutions, motions and discussions of papers unless otherwise directed by the presiding officer.

ARTICLE VII.

AMENDMENTS.

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

List of Members.

Aikins, Jos. K.,
Chief Clerk to Supt.
Pennsylvania R. R. Co.,
30th and Sarah sts., S. S.,
Pittsburgh, Pa.

Alexander, J. R.,
Air Brake Inspector,
Pennsylvania R. R. Co.,
Altoona, Pa.

Allen, Jas. P.,
Sales Agent,
Union Steel Castings Co.,
61st st. and A. V. Ry.,
Pittsburgh, Pa.

Allmon, Geo. S.,
N. E. cor. 14th & Market st.,
Wilmington, Del.

Ames, Geo. F.,
Rep. National Malleable
Castings Co.,
Hattersley Flats,
Toledo, O.

Anderson, E. H.,
Sec. and Treas.,
Pittsburg Oil Refining Co.,
429 First avenue,
Pittsburgh, Pa.

Anderson, H. T.,
Chief Draftsman,
Standard Steel Car Co.,
Frick Building,
Pittsburgh, Pa.

Armbrust, C. W.,
President, Manufacturers Ry.
Supply Co.,
Fisher Building,
Chicago, Ill.

Atterbury, W. W.,
General Manager,
Pennsylvania R. R. Co.,
Philadelphia, Pa.

Atwood, J. A.,
Chief Engineer,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Ayers, H. B.
General Supt.,
American Locomotive Co.,
Pittsburgh Works,
Allegheny, Pa.

Baker, Edwin H.,
Rep. Galena Signal Oil Co.,
43 Water st.,
New York, N. Y.

Bartley, Milton,
President American Nut &
Bolt Fastener Co.,
Frick Building,
Pittsburgh, Pa.

Bell, W. K.,
Inspector,
Pennsylvania R. R. Co.,
617 Kelly ave.,
Wilkinsburg, Pa.

Bellows, A. B.
Manager,
Pittsburgh Testing Laboratory,
325 Water street
Pittsburgh, Pa.

Berkebile, R. L.,
Asst. Chief Clerk,
Pressed Steel Car Co.,
Allegheny, Pa.

Bigelow, Harry T.,
Rep. Hale & Kilburn Mfg. Co.,
Fisher Building,
Chicago, Ill.

Billingham, Jos.,
Master Mechanic,
B. & O. R. R. Co.,
Cumberland, Md.

Blackall, Rob't H.,
Inspector,
Westinghouse Airbrake Co.,
Pittsburgh, Pa.

Blair, A. C.,
Secretary and Treasurer,
Youngstown Car Mfg. Co.,
Frick Building,
Pittsburgh, Pa.

Blattner, Jos.,
Cor. Allegheny ave. and Rebecca st.,
Allegheny, Pa.

Blest, M. C.,
Chief Draftsman,
Pressed Steel Car Co.,
1720 Buena Vista st.,
Allegheny, Pa.

Bole, Robt. A.,
Manager, Manning, Maxwell & Moore,
Park Building,
Pittsburgh, Pa.

Bonsall, J. S.,
Manager, American Engineer and Railroad Journal,
Sharon Hill,
Delaware Co., Pa.

Booth, J. B.,
J. B. Booth & Co.,
435 Liberty st.,
Pittsburgh, Pa.

Booth, Jas.,
J. B. Booth & Co.,
435 Liberty st.,
Pittsburgh, Pa.

Bowery, Fred.,
Rep. American Nut and Bolt Fastener Co.,
306 Frick Building,
Pittsburgh, Pa.

Bowery, F. J.,
Chief Draftsman,
McConway & Torley Co.,
48th st. and A. V. Ry.,
Pittsburgh, Pa.

Brady, Daniel M.,
President, Brady Brass Co.,
95 Liberty street,
New York, N. Y.

Brayton, Chas. A.,
President,
Standard Car Wheel Co.,
Cleveland, O.

Brendel, F. L.,
Train Master,
B. & O. R. R. Co.,
Connellsville, Pa.

Brittain, J. B.,
Asst. to Comp.,
Pennsylvania Lines,
Union Station,
Pittsburgh, Pa.

Brown, Benson E.,
General Sales Agent,
Acme White Lead & Color Co.,
Detroit, Mich.

Brown, E. W.,
Inspector,
Pennsylvania R. R. Co.,
619 Kelly avenue,
Wilkinsburg, Pa.

Brown, F. Herbert,
President, Brown & Zortman Machinery Co.,
Cor. Water and Wood sts.,
Pittsburgh, Pa.

Brown, Henry M.,
Manager,
Brown Car Wheel Works,
Buffalo, N. Y.

Brown, J. Alexander,
Manager Pocket List of R. R. Officials,
24 Park place,
New York, N. Y.

Brown, Jno. T.,
Vice Pres. and Gen'l Manager'
Damascus Bronze Co.,
Allegheny, Pa.

Brown, Raymond B.,
Manager,
Duquesne Reduction Co.,
Pittsburgh, Pa.

Brown, T. R.,
With Corrington Air Brake Co.,
40-42 Wall st.,
New York, N. Y.

Brown, W. R.,
Superintendent,
Lawrenceville Bronze Co.,
31st st. and Penn ave.,
Pittsburgh, Pa.

Buchanan, E. G.,
Rep. Carbon Steel Co.,
26 Cortlandt st.,
New York, N. Y.

Buchanan, W. J.,
Asst. M. C. B.,
B. & L. E. R. R. Co.,
Greenville, Pa.

Buckley, J. T.,
Rep. Jenkins Bros.,
Park Building,
Pittsburgh, Pa.

Campbell, A.,
Standard Steel Car Co.,
1608 Fisher Building,
Chicago, Ill.

Campbell, G. M.,
Electrical Engineer,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Carpenter, Frank,
Rep. National Car Wheel Co.,
Keystone Branch,
Park Building,
Pittsburgh, Pa.

Carson, G. E.,
Gen'l Foreman Car Dept.,
P. & L. E. R. R. Co.,
McKees Rocks, Pa.

Caton, E. L.,
Dept. Manager,
U. S. Metal & Mfg. Co.,
1509 Arrott Building,
Pittsburgh, Pa

Caton, W. J.,
Chief Clerk to Pur. Agt.,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Caughey, E. G.,
Chief Engineer,
Standard Steel Car Co.,
10 Harrison ave.,
Bellevue, Pa.

Chipley, G. W.,
1102 Benton ave.,
St. Charles, Mo.

Clancy, J. R.,
429 North Salina st.,
Syracuse, N. Y.

Clark, Edward B.,
347 VanHooten Street,
Patterson, N. J.

Clarke, H. P.,
Supt. Mech. Dept.,
Pittsburgh Railways Co.,
Pittsburgh Pa.

Coffin, J. S.,
Manager,
Galena Signal Oil Co.,
Franklin, Pa.

Coffin, W. E.,
Rep. National Malleable
Castings Co.,
Care "The Stratford,"
Cleveland, O.

Cohill, A. A.,
Engineer,
Standard Steel Car Co.,
Butler, Pa.

Connolly, W. E.,
Superintendent,
Pennsylvania Car Wheel Co.,
499 Preble ave.,
Allegheny, Pa.

Conway, J. D.,
Chief Clerk to S. M. P.,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Coursin, J. F.,
General Foreman,
Pennsylvania R. R. Co.,
Pitcairn, Pa.

Courtney, D. C.,
President,
Courtney Bolster & Truck Co.,
1130 Sheffield st.,
Allegheny, Pa.

Courtney, W. J.,
Manager, Peerless Rubber
Mfg. Co.,
16 Warren st.,
New York, N. Y.

Cowan, John,
Master Car Builder,
Pennsylvania R. R. Co.,
Verona, Pa.

Crawford, D. F.,
Gen'l Supt. Motive Power,
Pennsylvania Lines West,
Pittsburgh, Pa.

Crouch, A. W.,
Engineering Dept.,
Dearborn Drug & Chemical Co.,
Park Building,
Pittsburgh, Pa

Crozier, R. J.,
Manager, Standard Supply & Equipment Co.,
811 Liberty ave.,
Pittsburgh, Pa.

Cullem, Jas. K.,
President,
Niles Tool Works,
Hamilton, Ohio.

Currie, J. C.,
Rep. Nathan Mfg. Co.,
92 Liberty st.,
New York, N. Y.

Dallam, C. B.,
President,
Pittsburgh Oil Refining Co.,
Box 1315,
Pittsburgh, Pa.

Darby, H. F., Jr.,
Rep. Cutter Electric & Mfg. Co.,
Farmers Bank Building,
Pittsburgh, Pa.

Davis, Thos. R.,
Rep. Wisconsin Graphite Co.,
Wilson, Pa.

DeArmond, W. C.,
President, Protectus Co.,
North American Building,
Philadelphia, Pa.

DeGress, Francis B., M. E.,
Manager,
Crocker Wheeler Co.,
39-41 Cortlandt st.
New York, N. Y.

Demerest, T. W.,
Supt. Motive Power,
Pennsylvania Lines,
Ft. Wayne, Ind.

DeRemer, W. L.,
Rep. Spencer-Otis Co.,
Plymouth Building,
Chicago, Ill.

Diamond P. R.,
District Manager,
Magnus Metal Co.,
Allegheny, Pa.

Donahue, C. J.,
Chief Clerk to S. M. P.
L. S. & M. S. Ry. Co.,
Cleveland, O.

Donahue, Geo.,
Meadville, Pa.

Doulin, W. M.,
Asst. Secty. & Treas.
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Dow, Geo. N.,
Master Car Builder,
L. S. & M. S. Ry. Co.,
Cleveland, O.

Dowdell, Augustus,
Rep. Valentine & Co.,
57 Broadway,
New York, N. Y.

Dreyfus, T. F.,
General Foreman,
Pennsylvania Company,
Mahoningtown, Pa.

Duntley, W. O.,
Vice President,
Chicago Pneumatic Tool Co.
Fisher Building,
Chicago, Ill.

Dunn, Gano S.,
V. Pres. & Chief Engr.,
Crocker Wheeler Co.,
Ampere, N. J.

Dunn, M.,
Supt. Motive Power,
Pennsylvania Lines West
Columbus, O.

Durrell, D. J.,
Asst. Engineer Motive Power,
Pennsylvania Lines,
Columbus, O.

Dyer, Jos.,
Chief Joint Inspector,
P. & L. E. and Erie R. R. Cos.
Youngstown, O.

Elmer, Wm., Jr.,
Asst. Engineer Motive Power,
Pennsylvania R. R. Co.
Altoona, Pa.

Evans, R.,
Purchasing Agent,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Evans, R. J.,
General Manager,
Franklin Mfg. Co.,
Franklin, Pa.

Evans, S. D.,
Master Mechanic,
Allegheny & South Side R. R. Co.,
10th & Muriel sts., S. S.
Pittsburgh, Pa.

Faul, G. H.,
Chief Clerk,
Youngstown Car Mfg. Co.,
Frick Building,
Pittsburgh, Pa.

Ferguson, W. L.,
Rep. Jas. B. Sipe & Co.,
400 Federal st.,
Allegheny, Pa.

Fitz, E. M.,
Motive Power Inspector,
Pennsylvania Lines,
295 North High st.,
Columbus, O.

Fitzgerald, Orrin,
Draftsman, Fisher Foundry & Machine Co.,
755 Cherokee st.,
Pittsburgh, Pa.

Flinn, C.,
General Superintendent,
Pressed Steel Car Co.,
Allegheny, Pa.

Ford, D. W.,
Chief Matl. Inspector,
Pennsylvania R. R. Co.,
617 Kelly ave.,
Wilkinsburg, Pa.

Forsburg, R. P.,
Chief Draftsman,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Francis, Jno. S.,
Mechanical Engineer,
331 Fourth ave.,
Pittsburgh, Pa.

Frost, Harry W.,
Manager
Berry Bros., Ltd.,
Detroit, Mich.

Galloway, W. S.,
Inspector,
B. & O. R. R. Co.,
Care S. M. P., B. & O. R. R. Co.,
Mt. Clare, Baltimore, Md.

Gately, Chas. L.,
Rep. Gold Car Heating and Lighting Co.,
Frankfort & Cliff sts.,
New York, N. Y.

Gayley, O. C.,
General Agent,
Safety Car Heating and Lighting Co.,
71 Broadway,
New York, N. Y.

Gearhart, H. J.,
General Manager,
Standard Steel Car Co.,
Frick Building,
Pittsburgh, Pa.

Gibb, J. B.,
Manager,
Railway Steel Spring Co.,
21st st. & Liberty ave.,
Pittsburgh, Pa.

Gies, Geo. E.,
General Foreman,
Pennsylvania Company,
1244 Juniata st.,
Allegheny, Pa.

Gilbert, E. B.,
Master Mechanic,
B. & L. E. R. R. Co.,
Greenville, Pa.

Gildroy, Geo. J.,
Supt. M. & H. Div.,
Lehigh Valley R. R. Co.,
Hazelton, Pa.

Gilpin, F. M.,
General Sales Agent,
Latrobe Steel Company,
1200 Girard Building,
Philadelphia, Pa.

Gilpin, H. E.,
General Superintendent,
Erie R. R. Co.,
Cleveland, O.

Gillen, Jno.,
Draftsman,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Gist, C. L.,
Supt. Transportation,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Gold, Egbert H.,
Car Heating Apparatus,
262-263 Monadnock Block,
Chicago, Ill.

Goodell, G. H.,
Railway Supplies,
516 Pioneer Press Building,
St. Paul, Minn.

Gray, Robert,
Asst. R. F. of E.,
P. & L. E. R. R. Co.,
Brunot avenue,
Esplen Boro., Pittsburgh, Pa.

Greenick, A.,
Draftsman,
Michigan Central R. R. Co.,
Detroit Mich.

Greer,, J. B.,
Manager,
Pittsburgh Filter Mfg. Co.,
Empire Building,
Pittsburgh, Pa.

Grieves, E. W.,
Rep. Galena Signal Oil Co.,
1756 Park ave.,
Baltimore, Md.

Groenlie, F. E. O.,
Draftsman,
Care M. M. "Burlington
Route,"
St. Joseph, Mo.

Grove, E. M.,
Treasurer,
McConway & Torley Co.,
48th st. and A. V. Ry.,
Pittsburgh, Pa.

Grooms, J. C.,
Land & Claim Agent,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Grubb, Jos. H.,
Rep. Hussey Binns Shovel Co.
Pittsburgh, Pa.

Gulland, Chas.,
Asst Plumber,
Pennsylvania R. R. Co.,
7941 Maderia st.,
Pittsburgh, Pa.

Haas, Ben,
Rep. Jos. Joseph Bros. Co.,
Park Building,
Pittsburgh, Pa.

Hall, H. F.,
Care American Sheet Steel Co.
Scottdale, Pa.

Hall, W. G.,
Clerk,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Hallett, R. C.,
Manager,
Automatic Heating Co.,
Keystone Bank Building,
Pittsburgh, Pa.

Hammond, O. J.,
General Freight Agent,
B. & L. E. R. R. Co.,
Carnegie Building,
Pittsburgh Pa.

Hansen, J. M.,
President,
Standard Steel Car Co.,
Frick Building,
Pittsburgh Pa.

Hare, John,
Rep. Niles Tool Works,
Frick Building,
Pittsburgh Pa.

Hart, Frank B.,
Manager of Sales,
Excelsior Car Roof Co.,
1167 Fourteenth ave.,
Detroit, Mich.

Harris, J. D.,
Asst. Chief Engineer,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

Hastings, Chas. L.,
Rep. Bethlehem Steel Co.
Keystone Bank Building,
Pittsburgh, Pa.

Hayes, Scott R.,
Rep. Railway Steel Spring Co.
71 Broadway,
New York, N. Y.

Herr, E. M.,
General Manager.
Westinghouse Air Brake Co.,
Pittsburgh, Pa.

Hirsh, Wm.,
Sales Agent,
American Steel & Wire Co.,
Pittsburgh, Pa.

Hobart, Nathaniel P.,
Rep. American Brake Shoe Co.,
170 Broadway,
New York, N. Y.

Hobson, Bailey E.,
President,
Tri-State Mining & Mfg. Co.,
248 Fourth ave.,
Pittsburg, Pa.

Hoffman, N. K.,
Chief Clerk to Gen'l. Supt.,
P. & L. E. R. R. Co.,
General office,
Pittsburgh, Pa.

Holbrook, David O.,
Vice President,
Pennsylvania Malleable Co.,
Frick building,
Pittsburgh, Pa.

Holmes, A. L.,
Asst. Master Mechanic,
West Penn Div., P. R. R. Co.,
Allegheny, Pa.

Hood, Chas. Y.,
Consulting Engineer,
Hood Automatic Window Co.,
700 Wood St.,
Wilkinsburg, Pa.

Hoof, J. L.,
Inspector,
Pennsylvania R. R. Co.,
909 Lexington ave.,
Altoona, Pa.

Howard, C. H.,
Vice President and Gen'l. Mgr.,
American Steel Foundries,
Columbia Building,
St. Louis, Mo.

Howe, David M.,
Manager,
Jos. Dixon Crucible Co.
2213 Farmers Bank Bldg.,
Pittsburgh, Pa.

Howgate, J. R.,
Superintendent,
American Locomotive Co.,
Pittsburgh Works,
Allegheny, Pa.

Hubbell, Ira C.,
Buyer,
K. C. M. & O. Ry. Co.,
Chemical Building,
St. Louis, Mo.

Hukill, J. L.,
President,
Hukill-Hunter Co.,
20 Wood st.,
Pittsburgh, Pa.

Hunter, H. S.,
Pittsburg Manager,
Chicago Pneumatic Tool Co.,
Empire Building,
Pittsburgh, Pa.

Hunter, R. F.,
Vice President,
Hukill-Hunter Co.
20 Wood st.,
Pittsburgh, Pa.

Huntley, F. P.,
Secretary,
Gould Coupler Co.,
25 W. 33d st.,
New York, N. Y.

Hurley, J. L.,
Draftsman,
13 Stanwix st.,
Pittsburgh, Pa.

Hussey, Jno. U.,
Mechanical Engineer,
Keystone Car Wheel Co.,
Park Building,
Pittsburgh, Pa.

Hyde, J. C.,
Superintendent,
B. R. & P. Ry. Co.,
Butler, Pa.

Hyndman, F. T.,
Master Mechanic,
B., R. & P. Ry. Co.,
DuBois, Pa.

Hyndman, H. R.,
Asst. General Freight Agent,
Washington Run R. R. Co.,
Conestoga Building,
Pittsburgh, Pa.

Hyndman, N. P.,
Gen'l Freight & Pass. Agent,
Washington Run R. R. Co.,
Conestoga Building,
Pittsburgh, Pa.

Illingworth, T. W.,
Rep. Midvale Steel Co.,
1527 Butler st.,
Philadelphia, Pa.

Jackson, M. R.,
Manager,
Schoen Steel Wheel Co.,
McKees Rocks, Pa.

Jackson, Thos.,
Manager Railway Dept.,
Mechanical Rubber Co.,
230 Randolph st.,
Chicago, Ill.

Jacoby, W. L.,
Rep. Latrobe Steel Co.,
11 Broadway,
New York, N. Y.

Jefferson, E. Z.,
Manager,
Pennsylvania Rubber Co.,
Empire Building,
Pittsburgh, Pa.

Jenney, Jacob,
G. F. C. R.,
Monon. Div. P. R. R. Co.,
32d street, S. S.,
Pittsburgh, Pa.

Johnson, A. B.,
Engineering Salesman,
Pressed Steel Car Co.,
Tradesman Building,
Pittsburgh, Pa.

Johnson, C. S.,
President,
Monongahela Foundry &
Forge Co.,
Monongahela City, Pa.

Johnson, Wallace W.,
Sales Manager,
Franklin Mfg. Co.,
4037 Girard ave.,
Philadelphia, Pa.

Johnson, Wm. T.,
Manager Philadelphia Branch
Dearborn Drug & Chemical Works,
The Bourse,
Philadelphia, Pa.

Jones, L. W.,
Sewickley, Pa.

Kalbaugh, I. N.,
Supt. Motive Power,
W. Va. Cen. & Pgh. Ry.,
Elkins, W. Va.

Kamerer, D. S.,
1101 Park st.,
McKeesport, Pa.

Kearney, Alexander,
Supt. Motive Power,
B. & O. R. R. Co.,
Pittsburgh, Pa.

Keith, Jno. T.,
Superintendent,
Lehigh Valley Ry. Co.,
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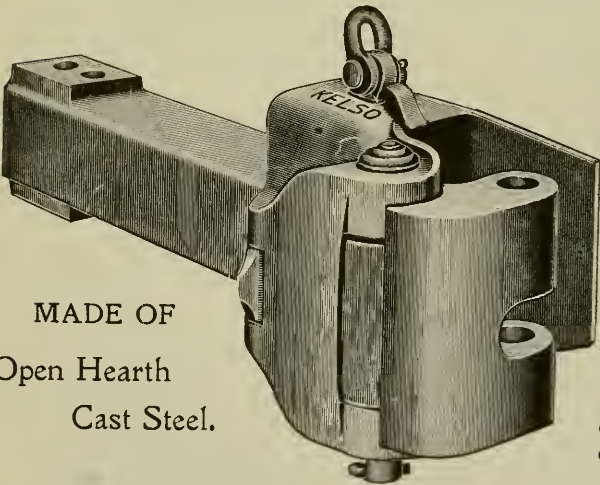

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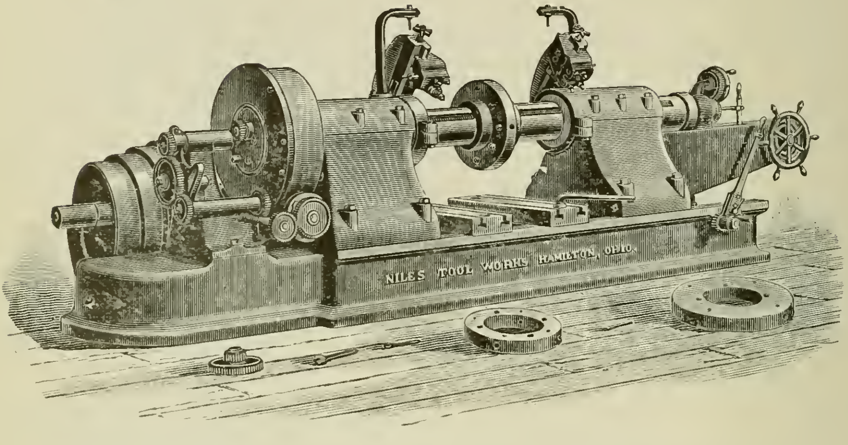
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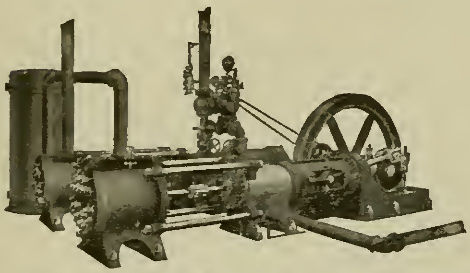

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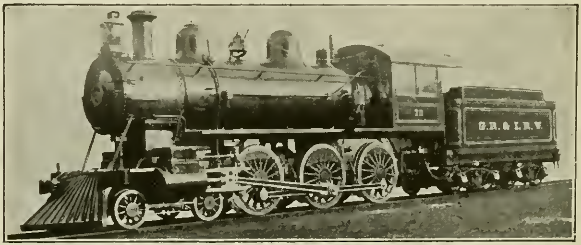

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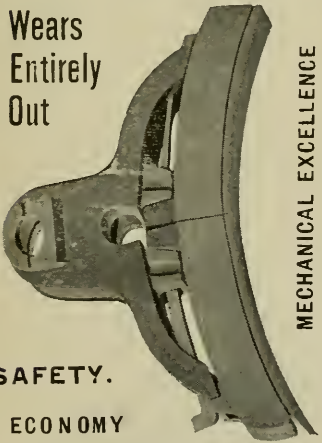

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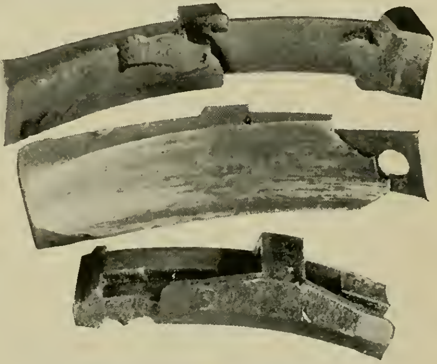

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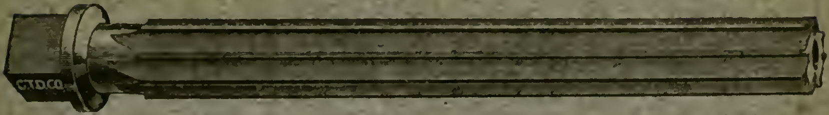

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